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AMERICAN JOURNAL OF OPHTHALMOLOGY

THIRD SERIES FOUNDED BY EDWARD JACKSON

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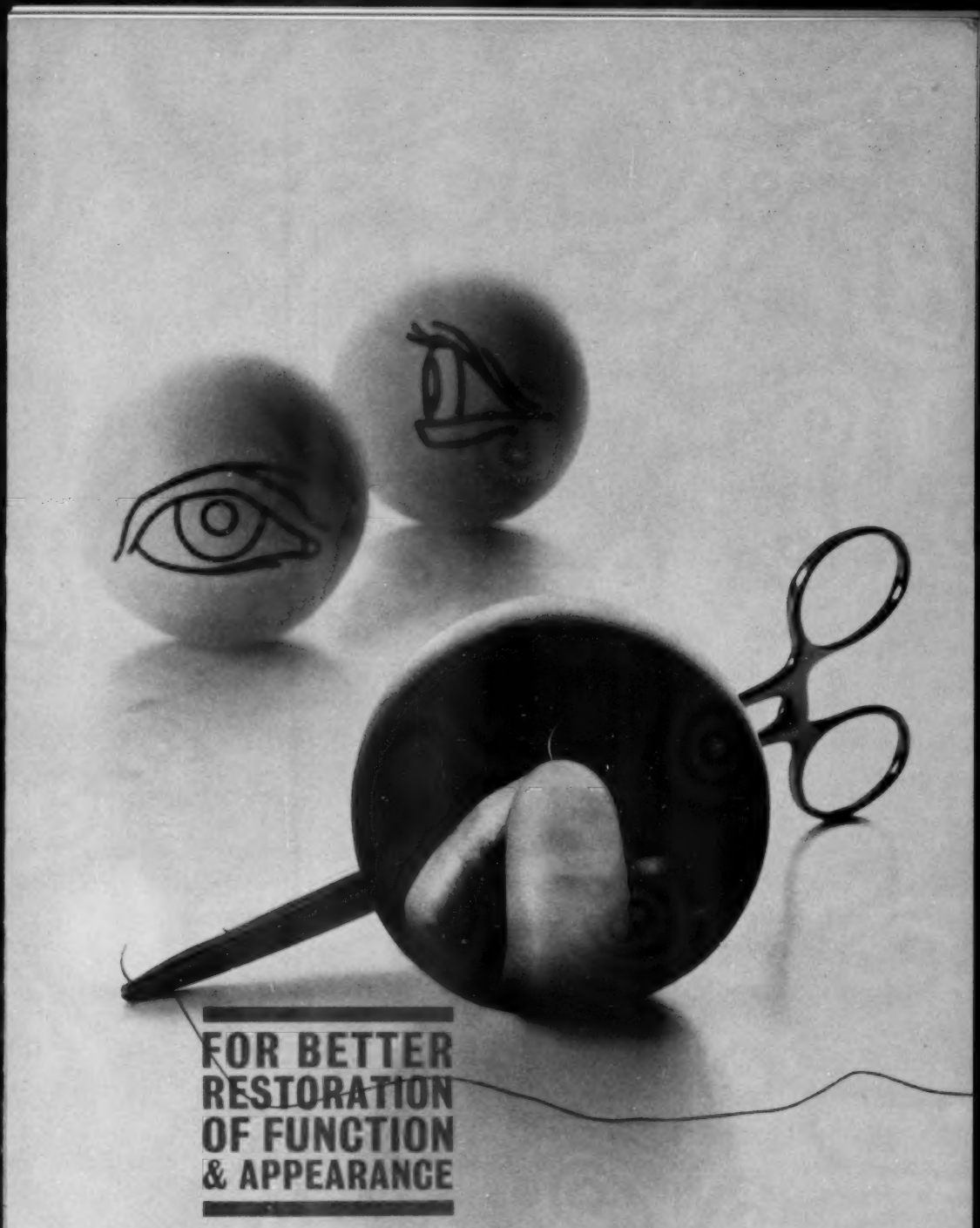

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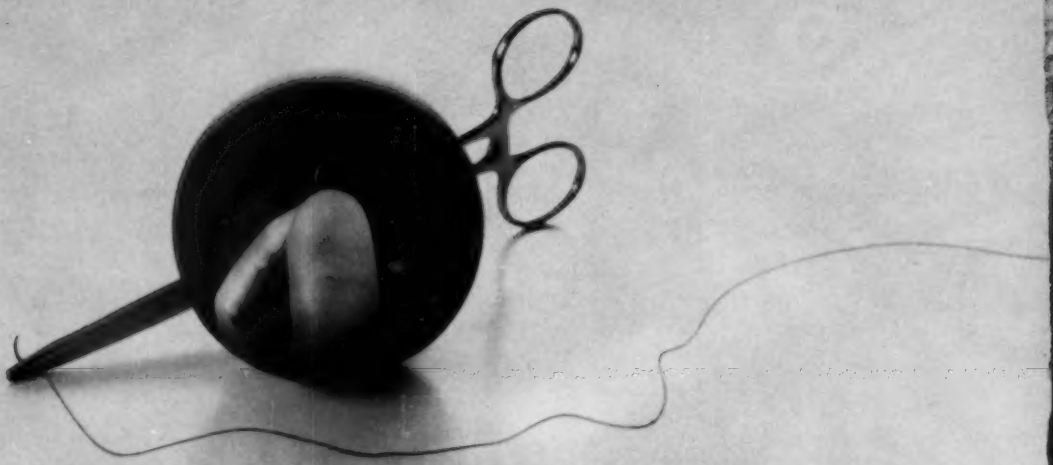

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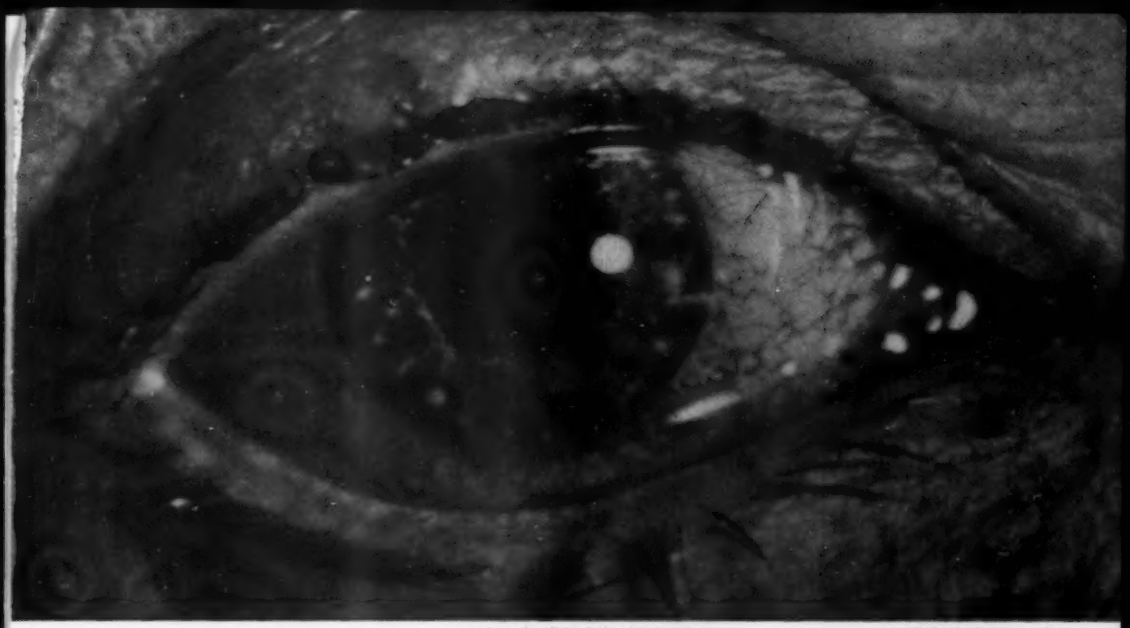

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[1] CLIFTON, C. E. AND HALL, N. C. "RE-STERILIZING ACTIVITY OF CERTAIN CONTACT LENS SOLUTIONS." CONTACTO, THE CONTACT LENS JOURNAL, 3:10, 201-3, 1959.

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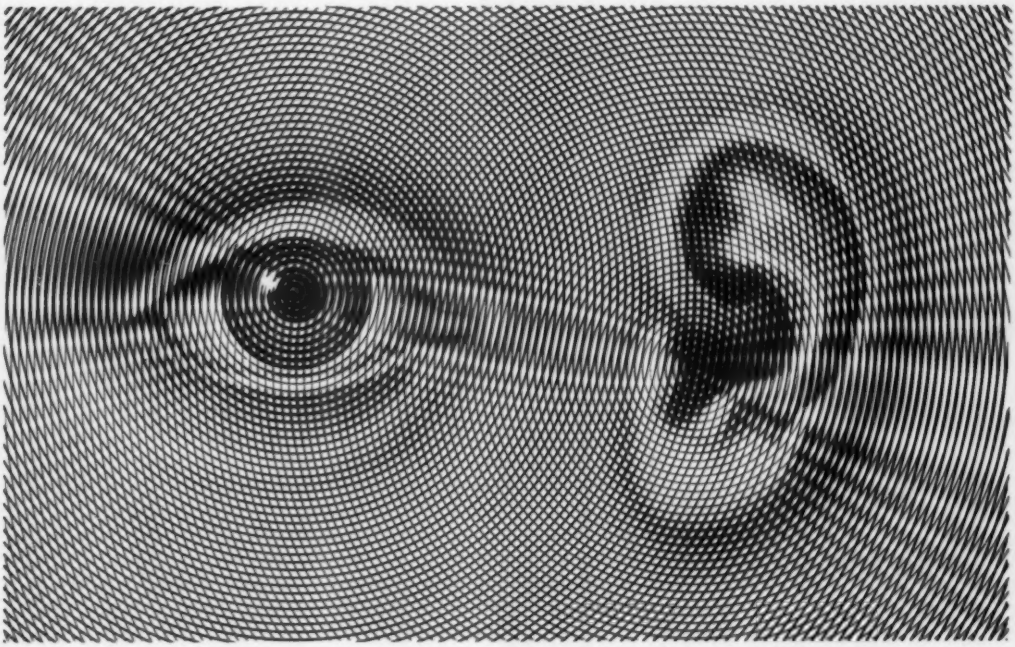

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*Witten, V. H.; Sulzberger, M. B., and Arthur, G. W.: *Clin. Pharmacol. & Therap.* 1:294 (May-June) 1960.

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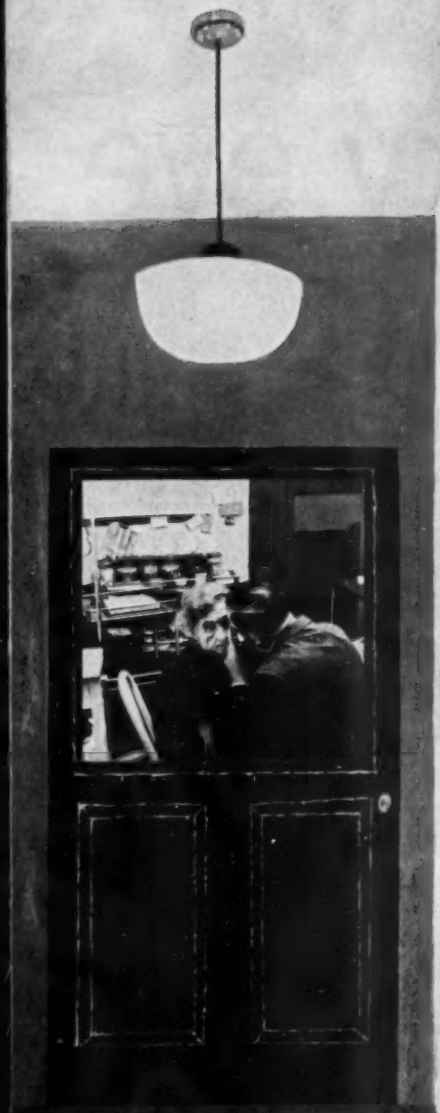

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L.E. + 50 + 2.75 × 175

The patient's interpupillary measurements were 65 distance and 62 near. We asked the doctor if the patient was having any trouble and the answer was a positive yes!

A check of the horizontal centers showed that instead of 65 mm. apart they were 69 mm. apart. At first glance this difference would seem to be the culprit and the reason for the patient's discomfort. A second glance, however, showed that through the 180th meridian the power of each lens was only ½ of a diopter and the error was only .2 in each eye, or a total of .4 overall—well within tolerance limits.

The lenses were checked again—this time for vertical centers—and the cause of the trouble was found. The center of the right lens was 1 mm. above the geometric center, and the center of the left lens was 1 mm. below the geometric center. This resulted in a prism of .625 or almost two thirds of a prism diopter of vertical imbalance. When the vertical centers were correctly placed the patient was comfortable.

We bring you this example because it is an established fact that some tolerance must be allowed in grinding small corrections. We have, with the help of some good ophthalmologists, prepared a table of tolerance limits which our shops adhere to meticulously. Below is our table of centering tolerances. Should you wish a complete tolerance table, write The House of Vision and you will receive one at once.

Lens Power	TOLERANCE—PER LENS IN MM.	
	Vertical Meridicn	Horizontal Meridian
+ or — .25	3.0 mm.	6.0 mm.
+ or — .37	2.5 mm.	5.0 mm.
+ or — .50	2.0 mm.	4.0 mm.
+ or — .75	1.3 mm.	2.6 mm.
+ or — 1.00	1.0 mm.	2.0 mm.
+ or — 1.25	.8 mm.	1.6 mm.
+ or — 1.50	.7 mm.	1.3 mm.
+ or — 1.75 to + or — 3.00	.5 mm.	1.0 mm.
Above + or — 3.00	.5 mm.	.5 mm.

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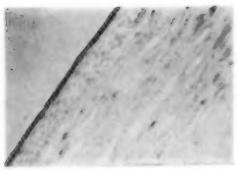

Fig. 1

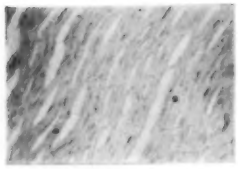

Fig. 2

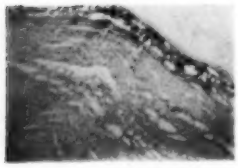

Fig. 3

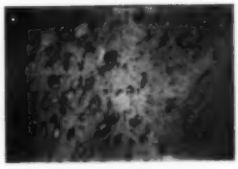

Fig. 4

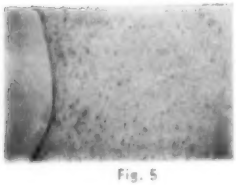

Fig. 5

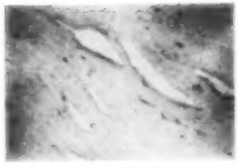

Fig. 6

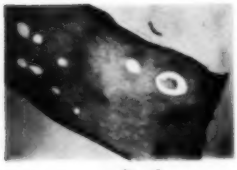

Fig. 7

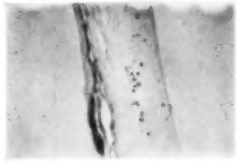

Fig. 8

Figs. 1 to 8 (Stocker, et al.). Morphologic and histochemical changes occurring in cat corneas during long-term glycerol freezing.

Fig. 1. Fresh cat cornea, colloidal iron stain. The collagen fibers are surrounded by blue stained material (mucopolysaccharides) which is evenly distributed (×107).

Fig. 2. Same as Figure 1, detail.

Fig. 3. Cat cornea frozen at —79°C. for 56 weeks after thawing, colloidal iron stain. The blue material is unevenly distributed. Some of the collagen fibers are completely depleted of it. Large accumulations are found, particularly beneath Descemet's membrane (×50).

Fig. 4. Same as Figure 3, high power (×107).

Fig. 5. Cat cornea frozen at —45°C. for 58 weeks after thawing, alcian blue stain. The distribution of the blue material is fairly regular. Nowhere are there large accumulations of it (×50).

Fig. 6. Same as Figure 5, colloidal iron stain, detail.

Fig. 7. Cat cornea frozen at —79°C. for 51 weeks during reconstitution, combined periodic-acid-Schiff and alcian blue stain. The vacuoles in the stroma contain blue material (×50).

Fig. 8. Rabbit cornea grafted with frozen homograft, clinically partly opaque, alcian blue stain. Corresponding to the opaque portion of the graft there is irregular accumulation of blue material (mucopolysaccharides) (×50).

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MORPHOLOGIC AND HISTOCHEMICAL CHANGES OCCURRING IN CAT CORNEAS DURING LONG-TERM GLYCEROL FREEZING*

F. W. STOCKER, M.D., M. TH. MATTON-VAN LEUVEN,† M.D., A. EIRING, M.S., R. GEORGIADE, M.A., AND N. GEORGIADE, M.D.

Durham, North Carolina

In a previous study[1] dealing with experimental perforating corneal grafts, glycerol freezing at −45°C was found to be the most favorable method of long-term preservation. The results suggested that besides the freezing temperature and the duration of the preservation, other factors present during the glycerol treatment, freezing, thawing and reconstitution might be important for the suitability of donor material for perforating corneal grafts. These factors might interfere with the viability of the corneal cells and also be responsible for changes in the corneal proteins and mucopolysaccharides.

The present study investigates morphologic and histochemical changes occurring in corneal tissue during the various stages of the process of preservation.

MATERIALS AND METHODS

Twenty-four corneas of adult cats were examined. The animals were killed by intraperitoneal injection of sodium pentobarbital (Nembutal). Immediately after death the corneas with a scleral rim of two or three mm. were excised. Four corneas, to be used as controls, were put in 10-percent aqueous solution of formalin immediately after excision.

Each of the other corneas was put in a screw-capped glass tube containing four cc. preservative fluid, that is, 20-percent glycerol and 80-percent Hanks' balanced salt solution, in which they soaked for one hour at room temperature. After this period of time, which is called glycerol treatment, three corneas were removed from the preservative and fixed in formalin. All the other tubes were sealed with tape and paraffin. Ten tubes were placed in the dry ice box at −79°C for periods of 51 to 59 weeks and seven tubes were placed in a mechanical refrigerator at −45°C for periods of 56 to 61 weeks. These temperatures were kept constant throughout.

After removal from the freezers, the tubes were put in a water bath at +37°C. One cornea of the −79°C group and one of the −45°C group were removed from the tube after a few seconds, as soon as they became separated from the block of frozen preservative and before the preservative was thawed completely. Thus, they were put into the formalin in a partially frozen state and fixed while in the process of thawing.

All the other tubes were kept in the water bath until the preservative containing the cornea was thawed completely. This required from two to four minutes, after which the corneas were removed. Seven corneas were immediately fixed in formalin. Eight others were put in pooled rabbit serum or horse serum at +37°C for periods from 20 min-

* From the Duke University School of Medicine, Department of Surgery, Plastic Surgery Research Laboratory and Division of Ophthalmology. This work was aided by U.S. Public Health Grant B-1161. Presented in part at the meeting of the Southeastern Section of the Association for Research in Ophthalmology, December 5, 1959, Augusta, Georgia.

† Fight for Sight Research Fellow of the National Council to Combat Blindness, Inc., New York, New York.

utes to six hours, after which they were fixed in formalin.

In this way histologic specimens were prepared of fresh control corneas, fresh corneas after glycerol treatment, and frozen corneas during thawing, after thawing and during reconstitution with serum.

Paraffin sections were made. They were stained by the routine hematoxylin-eosin stain and by the following techniques for histologic demonstration of mucopolysaccharides:

a. *Periodic-acid-Schiff stain* (PAS). This method uses periodic acid in combination with fuchsin-sulfuronic acid (Schiff's reagent).

The periodic acid oxidizes mucopolysaccharides and one of the reaction products is aldehyde. The aldehyde can be identified by converting it to a colored complex with Schiff's solution which gives a bright red color when it is combined with aldehyde.

b. *Alcian blue.* Alcian blue, a phtalocyanine dye, has the property of demonstrating acid mucopolysaccharides at a low pH range. Johnson's[2] modification (1957) of Steedman's[3] (1950) alcian blue method was used with counterstain of nuclear fast red. This procedure reveals the interfibrillar ground substance blue-green and the nuclei and cells red.

Alcian blue was used with and without application of hyaluronidase. Dried bovine testicular hyaluronidase (Wydase-Wyeth 1,500 u.) reconstituted with one cc. isotonic sodium chloride solution was used and applied during one hour.

c. *Dialyzed colloidal iron method of Hale.*[4] The colloidal iron method is based on the ability of acid mucopolysaccharides to bind colloidal iron. Treated with potassium ferrocyanide the substance containing iron is stained blue (Prussian blue reaction). The modification of Rinehart-Abul-Haj[5] (1951) was tried first. It was thought by these authors to demonstrate acid mucopolysaccharides more readily than the technique of Hale. In our investigation the modification of Mowry[6] (1959) was found to give better results and all our slides were stained following this latter technique. The method was used with and without application of hyaluronidase in the same way as described for alcian blue.

Results

Fresh cat corneas

1. *Fresh control corneas fixed in formalin immediately after excision.*

When stained with alcian blue the stroma appeared pale pink. Bowman's membrane, ill-defined, appeared in the same color. Descemet's membrane was well-defined and stained in a darker pink. The most superficial layer of the epithelium took a faint blue stain. The nuclei of epithelial, endothelial and stromal cells were dark pink. Throughout the stroma the collagen fibers were surrounded by a blue line. The blue material was distributed very evenly. The colloidal iron stain showed the fine blue lining of the stromal fibers more distinctively and the blue coloring of the superficial epithelial layers was more pronounced (figs. 1 and 2). When stained with PAS, the stroma was diffusely dark pink.

2. *Fresh corneas fixed after glycerol treatment for one hour.*

When stained with alcian blue the distribution of the blue material in the stroma was very similar to that found in the fresh control specimens. The collodial iron stain confirmed this finding. The superficial layers of the epithelium showed the same blue coloring as the control specimens. The PAS stain did not show any difference from the control specimens.

Frozen cat corneas

1. *During the thawing procedure.*

In the −79°C frozen cornea minimal edema and minimal cloudiness were observed at the moment of the removal from the still partially frozen preservative. On histologic

section the collagen fibers were surrounded by a blue lining, similar to the one found in the fresh control corneas. This blue material was evenly distributed over the stroma. There were a few localized areas where the regular pattern of the collagen fibers was disrupted and where accumulations of the blue material were present.

The −45°C frozen corneas presented the same appearance as the −79°C at this stage of the thawing process. Minimal edema and slight haziness were found at the moment of the removal from the preservative. The histologic findings were identical with the ones found in the specimen that had been frozen at −79°C.

2. *After complete thawing.*

When the completely thawed preservative was poured off, the −79°C frozen corneas were all opaque and were extremely edematous. Through the dissecting microscope under both the epithelial and endothelial surfaces bubbles were seen.

The hematoxylin-eosin sections showed a thickened stroma in which the collagen fibers were difficult to distinguish.

When stained with alcian blue or colloidal iron the stroma was pale pink, similar to the one in the fresh control corneas. The nuclei of the epithelial and endothelial cells did not show definite changes. The nuclei of the stromal cells were distorted and sometimes fragmented. The collagen fibers were less distinct, and, where they could clearly be identified, were not surrounded by the regular fine blue lining observed in the fresh cornea. In areas they were completely depleted of this lining. Large accumulations of blue material occurred in the spaces between the fibers, particularly near the epithelial and endothelial surfaces and toward both ends of the corneas. Numerous vacuoles were observed. They varied from tiny little holes to large round or oval cavities having a diameter of one-third to one-half of the cornea. A few vacuoles contained an amorphous material which was stained blue with alcian blue and colloidal iron (figs. 3, 4, and 7).

The corneas frozen at −45°C, examined after complete thawing, were much less edematous than the −79°C ones. They were clear or only slightly hazy. Under the dissecting microscope a few bubbles were seen in the periphery of the hazy corneas, but none in the clear ones.

In the histologic sections extremely few vacuoles were seen. The appearance of the collagen fibers was only slightly altered. When stained with alcian blue or colloidal iron there were some areas in which the blue lining of the collagen fibers was quite regular and almost comparable with the fresh control specimens. In other areas the collagen fibers showed little or no blue lining. Nowhere, however, were there heavy accumulations of blue material as described in the specimens which had been frozen at −79°C. Only in a very few vacuoles the amorphous blue material was seen. In summary, the distribution of the blue material was less regular than in the fresh control specimens, but much more regular than in the specimens frozen at −79°C (figs. 5 and 6).

3. *During the reconstitution with serum.*

The −79°C corneas soaked in serum for various lengths of time, were no longer edematous. They showed a general trend to clear during the process of reconstitution. A few became completely transparent. The above-mentioned bubbles disappeared gradually. The increase in transparency and the disappearance of the bubbles began and were most pronounced in the center of the corneas.

In the histologic specimens the disorganization of the blue lining was the same as seen in the specimens prepared directly after thawing. Numerous vacuoles were still visible, particularly toward both ends of the specimens. No vacuoles were seen in the scleral rim. With a combination of alcian blue and PAS the collagen fibers were

stained dark pink; the blue lining was no longer visible, but most of the vacuoles contained blue material, usually appearing as a network. Feulgen's stain for chromatin gave a negative result for this network. With hematoxylin-eosin it was stained very slightly in a light pink. With alcian blue or colloidal iron alone it was stained intensively blue (fig. 7).

The −45°C frozen corneas were all completely clear at the moment of fixation except for one which was hazy. This cornea had only been soaking in serum for 30 minutes and bubbles were present in its periphery. In the other corneas most bubbles had disappeared during the reconstitution period.

The histologic specimens did not differ from the ones prepared after complete thawing.

Histochemical use of hyaluronidase. In an attempt to identify the type of mucopolysaccharide, represented by the blue stained material, the sections prepared during the various stages of the preservation process were treated with hyaluronidase. No difference in the appearance of the alcian blue and colloidal iron sections before and after treatment with the enzyme was found.

Discussion

In a previous paper[1] it was pointed out that, besides the viability of the donor tissue, other factors might be of importance for obtaining transparent perforating grafts. Fielding and co-workers[7] did electrophoretic studies on stored corneas and concluded that the failure of cloudy donor material to clear after grafting might be more dependent upon protein changes than upon cellular viability. Several investigators[8–10] in studies on the transparency of the cornea emphasized the importance of the corneal mucopolysaccharides which surround the collagen fibrils. Maurice[11] suggests that any derangement of the lattice structure of the stromal collagen fibers, whether it is caused by swelling or mechanical stress, will result in loss of transparency. According to Woodin[10] the mucopolysaccharides take a prominent part in the swelling pressure of the cornea.

Dolenek and co-workers[12] think that in burns the primary opacity might be due to physicochemical changes of the colloidal system of the cornea, in which mucopolysaccharides are released from their fibrillar structures into the interfibrillar spaces, with consequent interference with the optical system.

Four methods are commonly used to demonstrate mucopolysaccharides in formalin-fixed, paraffin-embodied tissues: (a) the demonstration of metachromasia, (b) the periodic-acid-Schiff, (c) the colloidal iron stain, and (d) the alcian blue stain. In our experiments only the last three staining methods were used.

Most histochemists agree that none of these methods is absolutely specific for a particular mucopolysaccharide or group of mucopolysaccharides.

Although positive results with each of the methods identify chemical configurations which are common to many polysaccharides and other noncarbohydrate substances[13] the principles upon which the various techniques are based are probably different. Positive results obtained with two or more methods in sections of the same tissue can be valuable for the identification of mucopolysaccharides.

Mowry has indicated that alcian blue combined with PAS is a simple method for demonstration of acid carbohydrates. In our investigation the dark pink staining of the PAS covered the fine blue lining of the stromal fibrils, but in the vacuoles the amorphous material was still blue.

The fact that we obtained parallel results with either alcian blue and colloidal iron alone, as well as with the combination of alcian blue and PAS, leads us to the following conclusions: (a) The stromal fibers of the normal cat cornea are embedded in a matrix containing acid mucopolysaccharides. (b) During the process of preservation and especially during the thawing process this matrix substance loses its regular pattern and becomes dislocated, particularly in the

corneas frozen at −79°C. Its distribution in the −45°C specimens is less irregular than in the specimens frozen at −79C°.*

The dislocation of the mucopolysaccharide ground-substance is revealed by three facts: (a) the disappearance of the regular blue lining of the collagen fibrils, (b) the accumulation in clumps between the fibers and in the vacuoles, and (c) the tendency to move toward the surfaces and the edges of the cornea; clumps of blue material were seen especially near the endothelium, and in the vacuoles at the edges of the cornea. The fibers in the center were completely denuded in places, whereas the ones in the periphery were still surrounded by the blue material.

The network in the vacuoles most likely is composed of mucopolysaccharides. It is not chromatin as Feulgen's stain for desoxyribonucleic acid failed to stain it.

The question as to the nature of the mucopolysaccharides involved in the changes during the thawing procedure may be answered tentatively as follows. It has been shown that hydrolysis by hyaluronidase is positive for chondroitin and chrondroitin sulfate[14] and negative for keratosulfate.[15] The mucopolysaccharides that were stained by the above-mentioned techniques were not affected by the treatment with hyaluronidase during one hour. Since keratosulfate, the dominant component of the corneal mucopolysaccharide, is not hydrolyzed by hyaluronidase, we can conclude that the mucopolysaccharides we have demonstrated are most probably keratosulfate.

The irregular distribution of the mucopolysaccharides in the preserved corneal tissue cannot be related to the reconstitution process, as it is already seen in the specimens after complete thawing.

The fact that the −79°C frozen corneas were much more edematous than the −45°C ones and also showed more intensive changes in the distribution of the mucopolysaccharides suggests that the dislocation of the ground substance may be related in part to the swelling of the cornea during the thawing process.

The corneas still in a partially frozen state were less edematous than the completely thawed ones and the pattern of distribution of the mucopolysaccharides approached the one present in the control specimens.

The swelling which occurs during the thawing process may be due to the uptake of fluid from the preservative. The simultaneously occurring changes in the mucopolysaccharides may be due to factors related to this fluid uptake, such as dissolution of the reacting mucopolysaccharide fraction with consequent dislocation of it. In agreement with this supposition are Ashton's findings of a decrease in intensity of the alcian blue and colloidal iron stain in edematous rabbit corneas.[16]

The histologic findings in frozen corneas were compared with the changes present in a cornea after grafting with frozen donor material. Alcian blue sections were prepared from a grafted rabbit cornea 24 weeks after the operation. There was a striking parallelism between the appearance of the graft in vivo and the histologic findings. The transparent part of the graft corresponded with a regular pink-blue pattern of the stroma, whereas the opaque area showed marked disorganization of the blue material (fig. 8). These findings are in agreement with Maurice's theory that an intact pattern of collagen fibers with undamaged ground substance is important for corneal transparency.

It has been shown that in a graft the mucopolysaccharides are replaced slowly and only partially by the host, and that there is no replacement of the stromal fibers.[17] Therefore, efforts should be directed toward obtaining donor material with a pattern of distribution of mucopolysaccharides among the collagen fibers as closely resembling fresh corneal tissue as possible. From our investi-

* Dr. Sam T. Jones, Department of Ophthalmology, University of Oregon Medical School, kindly processed three of our corneas with slightly different alcian blue and colloidal iron staining techniques and obtained results comparable with ours.

gation it appears that the most critical period of the whole process of preservation is the thawing of the frozen cornea during which the stromal pattern is disorganized by swelling of the cornea. Further studies will thus be necessary to avoid this edema. The freezing temperature of −45°C might be used to greater advantage to achieve this goal as corneal edema was considerably less and the macroscopic and histologic findings closer to normal in the corneas frozen at −45°C than in the ones frozen at −79°C.

Summary and Conclusions

Twenty-four cat corneas were examined to determine histologic and histochemical changes occurring during long-term preservation by glycerol freezing. Particular attention was paid to the changes in the distribution of the mucopolysaccharides.

When the corneas which had been kept in the frozen state for roughly one year were examined during the thawing, little change in the distribution of the mucopolysaccharides was observed.

After complete thawing, the corneas frozen at −79°C. showed marked changes in the distribution of the mucopolysaccharides. These changes were much less pronounced in the corneas frozen at −45°C.

It is suspected that besides the reduced viability the marked dislocation of the mucopolysaccharides occurring in the corneas frozen at −79°C might be responsible for the poor results obtained in experimental grafts with this type of donor material as in contrast to the more favorable results obtained with donor corneas frozen at −45°C.

1110 West Main Street

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PHLYCTENULAR KERATOCONJUNCTIVITIS AT POINT BARROW, ALASKA

CLYDE FARSON, M.D.
Balboa Heights, Canal Zone

An association between tuberculosis and phlyctenular keratoconjunctivitis has long been observed. That the phlyctenule represents an allergy to endogenous bacteria is a widely accepted theory, also that the responsible bacterium is commonly tuberculosis. The pathologic histology of the lesion itself has never yielded any clue to the etiologic agent but it has been possible to reproduce the lesion by instillation of tuberculin into the conjunctival sac of tuberculous animals or human beings. [1,2]

Other granulomatous diseases are capable of producing phlyctenular keratoconjunctivitis.[3] The major role of tuberculosis in phlyctenular keratoconjunctivitis etiology continues to be disputed. It is the purpose of this paper to contribute to the statistics on the coincidence of tuberculosis with phlyctenular keratoconjunctivitis.

In Alaska this entity is still prevalent among the Indian and Eskimo population. The following data were obtained while I was the medical officer at the Barrow Hospital (U.S. Public Health Service) during 11 months of 1957 and 1958. The hospital serves the natives of the Arctic coast of Alaska, most of whom live in the village of Barrow which has a semipermanent population of over 1,400 Eskimos. The hospital maintains a complete medical file on every individual in the village and obtains a chest X-ray film on everyone at least annually. Thus a special opportunity for statistical correlation was afforded.

For this study the charts of all children born in a four-year period expected to yield highest incidence of reliable phlyctenular keratoconjunctivitis records, were checked. There were 164 individuals in this group aged 6.5 to 10.5 years. Phlyctenular keratoconjunctivitis, like verneal conjunctivitis, is primarily a disease of children. I made the diagnosis of acute phlyctenular keratoconjunctivitis in about 10 persons (some of whom had recurrences). One was a girl, aged 19 years, but all the other active lesions I saw were in children between six and 12 years of age. A number of adults exhibited corneal scars which some of them attributed to "tuberculosis eyes" in childhood.

The diagnosis of phlyctenular keratoconjunctivitis in this population is not particularly tenuous. In the ones I saw there was a prominent solitary phlyctenule on the limbus with focal conjunctivitis and considerable photophobia and malaise. There was no epidemic conjunctivitis in the village during my stay and, judging from the records also, phlyctenular keratoconjunctivitis is virtually the only type of conjunctivitis for which these people seek treatment. A diagnosis of phlyctenular keratoconjunctivitis was accepted if so stated by me (seven cases), or by my immediate predecessor who was in Barrow from 1955 to 1957 (eight cases), or by another physician present in Barrow in 1952 (four cases).

There were a number of patients with recurrent conjunctivitis treated by nurses when no physician was available before 1952 and during 1953 and 1954. Of these, seven were subsequently noted to have corneal scars by a visiting EENT specialist and so were included as established cases of phlyctenular keratoconjunctivitis. Thus there was a total of 26 children with well-documented phlyctenular keratoconjunctivitis in a group of 164. Another 39 individuals had been treated with topical steroids for unspecified conjunctivitis—20 of these had recurrent episodes. I believe that most of these were also phlyctenular keratoconjunctivitis, since other types of conjunctivitis are rarely seen in Barrow, but they will be designated merely as possible cases of phlyctenular keratoconjunctivitis

TABLE 1

RELATION TO TUBERCULIN RESPONSE

	Definite PKC	Possible PKC	No PKC	Total
Number of cases	26	39	99	164
Number tuberculin pos.	25	38	67	130
Number tuberculin neg.	1	1	32	34
Percent tuberculin neg.	3.8	2.6	32.3	20.7

since the diagnosis was not specified by a physician.

CORRELATION WITH TUBERCULIN RESPONSE

At the time this survey was made in June, 1958, 130 of the children were tuberculin positive. The remaining 34 had had negative reactions to intermediate strength tuberculin within the previous 12 months. Of the 26 definite cases of phlyctenular keratoconjunctivitis all but one were tuberculin positive. The single exception was the case of an eight-year-old girl who had two undoubted episodes of phlyctenular conjunctivitis in 1957, each diagnosed by a different physician, but her tuberculin test was repeatedly completely negative in 1957 and 1958 (I repeated it twice using fresh testing material). However, she did have BCG inoculation in 1953 and has a tuberculin-positive sister with phlyctenular keratoconjunctivitis. The fact that she was tuberculin negative but had had BCG is not remarkable since there were 20 other children in this series who were also tuberculin negative but had received BCG in 1953. It is thought that the BCG skin reaction diminishes to nothing after several years. In the group of 39 children who were treated for unspecified conjunctivitis at some time by nurses, only one was tuberculin negative.

From Table 1 it can also be seen that, of 130 tuberculin-positive individuals, 25 (19 percent) had phlyctenular keratoconjunctivitis and, if the less certainly diagnosed group of 38 is included, 63 (48 percent) were affected. But in the tuberculin-negative group totalling 34 individuals only one (three percent) or possibly two (six percent) were affected. These findings are similar to those of Thygeson and Fritz who, in 1949, found 35 percent of 404 Alaska native boarding school children with active phlyctenular keratoconjunctivitis or typical corneal scars. Among a similar group who were tuberculin tested 100 percent of 115 phlyctenular keratoconjunctivitis cases were positive while 6.9 percent of 360 children with no phlyctenular keratoconjunctivitis were negative.[2] In a group of 346 native children Fritz[4] found 44 percent with evidence of phlyctenular keratoconjunctivitis.

In Table 2, BCG does not appear to be incriminated as a cause of phlyctenular keratoconjunctivitis, although 87 of the 164 children were inoculated. The fact that a child had BCG does not rule out the possibility that primary infection with true tuberculosis may have occurred subsequently also. The phlyctenular keratoconjunctivitis group does not have a higher percentage of BCG inoculated individuals.

In the past it has been typical for Eskimo

TABLE 2

RELATION TO BCG INOCULATION

	Definite PKC	Possible PKC	No PKC	Total
BCG inoculation	9*	18	60†	87
No BCG	17	20	40	77

* Includes 1 tuberculin-negative individual.
† Includes 19 tuberculin-negative individuals.

TABLE 3

AVERAGE AGE WHEN TUBERCULIN POSITIVITY WAS DISCOVERED IN CHILDREN WHO DID NOT RECEIVE BCG

	Definite PKC	Possible PKC	No PKC
Number of children	16	17	30
Average age at conversion (yr.)	4.2	3.7	4.5

children to convert to tuberculin positivity at an early age. As shown in Table 3 the average age when a positive tuberculin was first recorded was a little over four years in these children. It can be assumed that conversion took place months before it was detected in most cases. Out of the entire group of 63 in Table 3 there were seven individuals who converted at an age younger than two years.

Examining the dates of occurrences and recurrences in relation to the probable date of tuberculin conversion in a few cases suggests that phlyctenular keratoconjunctivitis has its onset within a few months of the time of conversion with recurrences during one to four years following.

None of the entire group of 164 Eskimo children showed extensive scarring or infiltrates on chest X-ray examination. All were reported negative, primary inactive, or primary arrested, except two, and neither of these had phlyctenular keratoconjunctivitis. The rate of clinical tuberculosis is approximately the same in groups with and without phlyctenular keratoconjunctivitis, as shown in Table 4.

Effective treatment is available. The inflammation subsides in 24 to 48 hours with topical steroid therapy, with insignificant scarring at the limbus. Recurrences can be treated effectively as they appear.

SUMMARY

In the Eskimo village of Barrow all the children aged 6.5 to 10.5 years, a group of 164 individuals, were selected for a statistical study of the correlation between phlyctenular keratoconjunctivitis and positive tuberculin skin reaction, and other factors. Of 130 tuberculin-positive children, 19 percent had an established diagnosis of phlyctenular keratoconjunctivitis. Including less well-established diagnoses brought the incidence to 48 percent. Many Eskimo children have had a primary infection with tuberculosis at a very young age. The average age of tuberculin conversion was about four years in this group. It would appear that a primary tuberculosis infection, when it occurs in earliest childhood, will result in recurrent phlyctenular keratoconjunctivitis during the next few years in a large percentage of individuals at least among the Eskimo race. There were negligible pulmonary X-ray pathologic findings among all these children, and there was no greater incidence of recognized clinical tuberculosis among those with phlyctenular keratoconjunctivitis.

There were two individuals with phlyctenular keratoconjunctivitis but negative tuberculin reaction (one case was studied very closely), so it is evident that there must be a small residual group in which tuberculosis sensitivity is not to blame or is not demonstrable.

Box O, Gorgas Hospital.

TABLE 4

RELATION OF PKC TO CLINICAL TUBERCULOSIS

	Definite PKC	Possible PKC	No PKC
Hospitalized for tuberculosis	2	2	4
Home chemotherapy only	6	11	19
Pos. tuberculin, no clinical tuberculosis	17	26	45

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FURTHER EVALUATION OF AMPHOTERICIN-B THERAPY IN PRESUMPTIVE HISTOPLASMOSIS CHORIORETINITIS*

CONRAD L. GILES, M.D. AND HAROLD F. FALLS, M.D.
Ann Arbor, Michigan

The use of amphotericin B (Fungizone, Squibb) as a therapeutic agent, in the management of selected cases of chorioretinitis, was suggested by us.[1] In that report the literature was reviewed, nine personal cases were analyzed and an outline for selection, treatment, and management of suspected cases of histoplasmosis chorioretinitis was presented. Continuation of such therapy has enabled us better to establish criteria for the selection of cases to be treated.

Successful therapy, to date, seems to be most likely if the patient and laboratory findings presents the following: (1) positive histoplasmin skin test; (2) complement fixation titers of 1:8 or greater; (3) "typical" ophthalmoscopic picture of chorioretinal macular disease.

Emphasis must again be placed upon the fact that the administration of this drug is not without danger. The drug is highly nephrotoxic and may, in addition, manifest hematopoietic as well as hepatic toxicity. The therapeutic regimen was outlined in the previous paper and nothing in our continued experience would lead us to recommend any modifications.

This report deals with six new cases which fulfill the selection criteria already mentioned.

METHOD OF SELECTION OF PATIENTS

Patients referred to the University of Michigan Medical Center for evaluation and treatment of posterior uveal disease receive an extensive work-up in an attempt to implicate an etiologic agent. This consists of a chest microfilm, hematocrit, urine albumin and sugar and a serologic test for syphilis (Kahn test).

In addition to a complete ophthalmologic examination, skin testing for tuberculosis, histoplasmosis, toxoplasmosis, coccidioidomycosis, blastomycosis and lymphogranuloma venereum (Frei test) is done. Blood for complement fixation studies of histoplasmosis, coccidiodomycosis and blastomycosis as well as for Sabin-Feldman dye titers (when indicated) is obtained. Brucella agglutination determinations are also made. Otology, urology, gynecology, internal medicine and oral surgery consultations are requested in selected cases.

According to Woods[2] a tentative diagnosis of chorioretinitis due to histoplasmosis can be made if (1) no other etiologic agent is implicated, (2) pulmonary calcification is found, (3) anergy to tuberculin is present and (4) a positive immunologic test for histoplasmosis is demonstrated.

These criteria have been modified by us to include all those patients with clinically suspicious chorioretinal lesions who exhibit a positive immunologic test for histoplasmosis with or without allergy to tuberculin and pulmonary calcification.

Admittedly anergy to tuberculin and pulmonary calcification would reinforce a pre-

* From the Department of Ophthalmic Surgery of the University of Michigan Medical Center.

sumptive diagnosis of histoplasmosis but it is difficult to say that the absence of either would exclude such a presumption. Concomitant or old infection of histoplasmosis and tuberculosis is not rare.[3,4] and therefore it seems reasonable to accept positive skin testing to both diseases in the absence of activity of one condition as a not infrequent recurrence. Pulmonary calcification occurs in both histoplasmosis and tuberculosis though it is not a constant finding in either disease.

The six patients analyzed in the report all had immunologic evidence of histoplasmosis and in three cases (1, 4, 5) rising titers to the complement fixation test were obtained. All but one (Case 4) showed anergy to tuberculin and five of the six (all but Case 6) demonstrated pulmonary calcification.

The only other possible etiologic factor uncovered in the diagnostic survey was toxoplasmosis, four of the six patients showing positive Sabin-Feldman dye titers in varying degree. This finding will be discussed later in this report.

In summary, therefore, all patients who demonstrated clinically suspicious chorioretinal lesions, associated with positive histoplasmosis complement fixations and histoplasmin skin hypersensitivity were treated with intravenous amphotericin-B.

Case histories

Case 1

B. J. T. (registration number 921734), a 40-year-old white man, noted the onset of a blind spot in his left eye one week prior to consultation on March 16, 1959. No treatment was instituted prior to the time of his referral. Vision at that time was 20/20, O.D., and 20/40—, O.S. External and slit-lamp examinations were normal in both eyes. Ophthalmoscopy revealed many areas of old healed chorioretinitis in each eye. In the macular area of the left eye a mottled, flat, circular lesion, with surrounding macular edema and segments of interdigitating areas of increased pigmentation and depigmentation, was seen. Visual fields showed a paracentral scotoma with extension to the fixation point (fig. 1). Diagnoses of healed chorioretinitis, O.U., and subacute central chorioretinitis, O.S., were made and the usual uveitis work-up was instituted.

The patient returned on March 18, 1959, at which time no change was noted in the appearance of the chorioretinal lesion. Histoplasmin was the only positive skin test noted at that time. Because of impending macular destruction the patient was admitted to the University of Michigan Hospital and amphotericin-B therapy was begun prior to receipt of the complement fixation report.

One gm. of amphotericin-B was administered in 20 equally divided 50 mg. doses over a period of 24 days. While on the drug, the patient noted chills, headache, muscular aching, drowsiness, dizziness and nausea. Aside from the blood urea nitrogen which rose to 28 mg. percent and two temperature elevations of 100°F. no side-effects were noted. After four days of therapy, on March 24, 1959, the vision rose to 20/30, O.S., and just prior to discharge on April 8, 1959, the visual acuity was 20/20—. The macular edema subsided. Repeated visions and visual fields recorded during the next four months revealed visual acuities from 20/25+ to 20/20— and regression of the scotoma from the fixation point (fig. 1).

Positive findings in the initial uveitis work-up included the positive histoplasmin skin test, calcified hilar nodes and a negative histoplasmosis complement fixation test. A repeat complement fixation study, drawn on April 11, 1959, however, was positive in both antigens (1 [yeast phase] and 2 [my-

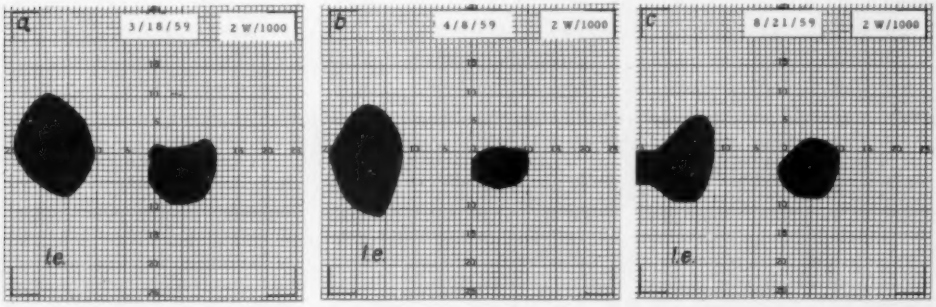

Fig. 1 (Giles and Falls). *Case 1*, central fields left eye, (a) first visit, (b) after two weeks of amphotericin-B therapy and (c) four months after discharge.

celial phase]) to a 1:64 titer. Another complement fixation test on August 21, 1959, the time of the last observation of the patient revealed a drop to 1:8 in each antigen.

The patient was given sulfadiazine 4.0 gm orally in four divided doses at the time of discharge, and for two months following completion of the amphotericin-B therapy.

CASE 2

N. F. (registration number 939486), a 33-year-old white man, presented at the University of Michigan Medical Center on October 29, 1959, with a history of distorted vision in the left eye noted one month prior to his visit, at which time his visual acuity was 20/15, O.U. Macular edema was seen by his ophthalmologist and he was treated with nicotinic acid and vitamins. Two weeks later the vision had fallen to 20/80—, O.S., and Medrol (4.0 mg. q.i.d.) was started. The macular lesion at that time was described as discrete, elevated, two thirds of the disc diameter in size, with a collarette of hemorrhages present. The vision on October 27, 1959, was recorded as 20/30, O.S.

At the time of the first University of Michigan Hospital evaluation on October 29, 1959, the vision was 20/15, O.D. and 20/40—O.S. A small alternating exotropia was noted at near and far. The slitlamp examination was normal. The lesion in the left fundus was unchanged from the original description. A diagnosis of subacute central chorioretinitis O.S. was made and because of the character of the lesion tapering off of steroids and instigation of typhoid-H antigen was advised pending the return of laboratory data.

The complete uveitis work-up revealed a positive histoplasmin skin test, histoplasmosis complement fixation positive in 1:8 dilution in antigen 1 and pulmonary calcification. The tuberculin and toxoplasmin skin tests were negative.

The patient returned on November 19, 1959, and because of the positive histoplasmosis complement fixation and a drop in visual acuity to 20/80, O.S., amphotericin-B therapy was started on November 21, 1959, with 0.85 gm. of amphotericin-B being administered over a period of 19 days in 17 equally divided doses. The use of phenergan 25 mg. (o) and aspirin 640 mg. prior to the infusion obviated subjective side-effects. The BUN rose to 35 mg. percent on one occasion, necessitating a halt in therapy for two days, but all other laboratory values remained within normal limits.

Nine days after the start of therapy, on November 30, 1959, the vision improved to 20/40. Three weeks after completion of infusions the vision was 20/40+ and all hemorrhages had disappeared from the macula. The last follow-up examination, four months later, revealed the same acuity. The lesion was quiet.

Sulfadiazine 1.0 gm. (o) q.i.d. was used in this case for a period of two months following discharge.

TABLE 1

HISTORY, PREVIOUS TREATMENT AND PERTINENT DIAGNOSTIC FINDINGS IN CASES REPORTED

Case No.	Name	Age (yr.) Sex	History of Lesion	Prior Treatment	Histoplasmosis Complement Fixation			Sabin-Feldman Dye Titer	Chest X-ray	O.T.
					Date	Ant. 1	Ant. 2			
1	B. J. T.	40 M	Scotoma, left eye, 1 wk.	None	3-16-59 4-11-59 8-21-59	0 1:64 1:8	0 1:64 1:8	Negative	Positive	Negative
2	N. F.	33 M	Distortion of vision left eye, 1 mo.	Steroids THA	10-29-59	1:8	0	Negative	Positive	Negative
3	R. G.	38 F	Scotoma, left eye, 7 mo.	Anti-TBC Steroids	5-19-50	0	1:8	Positive 1:128	Positive	Negative
4	G. S.	44 M	Scotoma, left eye, 2 mo.	None	3-26-59 6-25-59 7-23-59 12-10-59 1-21-60 4-28-60	0 1:16 —0	1:8 1:8 0	Positive 1:64	Positive	Positive
5	C. T.	52 M	Blurring of vision, right eye, 4 mo.	Steroids	2- 5-59 3-31-59	0 1:32	1:8 1:8	Positive 1:8192	Positive	Negative
6	R. T.	26 M	Scotoma, left eye 3 yr., right eye 2 yr.,	Steroids	3-20-59 6- 2-59 11-27-59	1:8 1:8 0	0 0 0	Positive 1:32	Negative	Negative

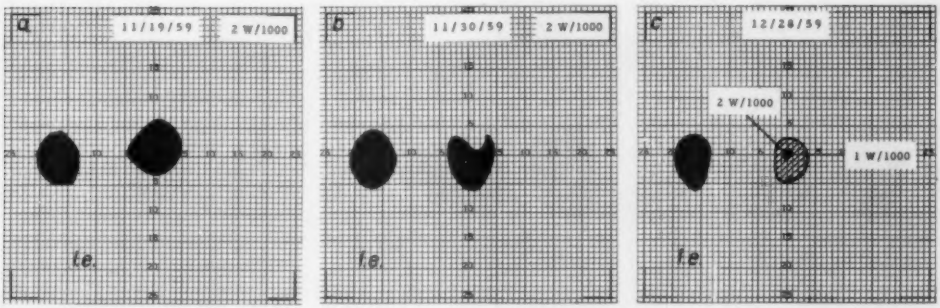

Fig. 2 (Giles and Falls). *Case 2,* central fields, left eye (a) prior to therapy, (b) after nine days of amphotericin-B treatment and (c) after completion of therapy.

CASE 3

R. G. (registration number 926643), a 38-year-old white woman, referred to the University of Michigan Medical Center from Guatemala City, Guatemela, for evaluation of a suspected melanoma in her left eye. The patient, first seen in University Hospital on May 19, 1959, had first noted diminished acuity in her left eye in September, 1958. A medical survey at that time was unrevealing and a program of steroid and antituberculous therapy was employed without success and with continued loss of vision in that eye.

The vision on May 19, 1959, was recorded as 20/20, O.D., and 20/200 O.S. External and slit-lamp examinations, as well as ophthalmoscopic examination of the right eye, were normal. The left eye exhibited an elevated, gray, cystlike macular lesion with surrounding edema and a collarette of hemorrhage inferiorly. There was a slight vitreous haze associated with the defect and a central field examination revealed a large central scotoma.

A diagnosis of subacute central chorioretinitis, O.S., was made.

The positive findings in the initial diagnostic work-up included positive histoplasmin and toxoplasmin skin tests and a calcified nodule at the base of the left lung. Because of the macular involvement and the ophthalmoscopic picture of the lesion, treatment with intravenous amphotericin-B was started prior to receiving the Sabin-Feldman and fungal complement fixation reports.

The patient was admitted to University Hospital on May 23, 1959, and received 1.0 gm. of amphotericin-B in 20 equally divided doses over a period of 20 days. No rise in the blood urea nitrogen or febrile response was noted. Reported side-effects included nausea, headache, dizziness and painful arms at the site of infusion.

Near the completion of therapy the two blood reports were received and revealed a positive histoplasmosis complement fixation of 1:8 in antigen 2 and a Sabin-Feldman dye titer of 1:128.

Six days after institution of treatment the vision improved to 20/60. The final recorded visual acuity was 20/60, J7 in the left eye. This was obtained two weeks after the last intravenous dose. The central field examination showed a smaller central scotoma. The collarette of hemorrhages cleared slowly.

CASE 4

C. S. (registration number 922507), a 44-year-old white man, was first seen in the University of

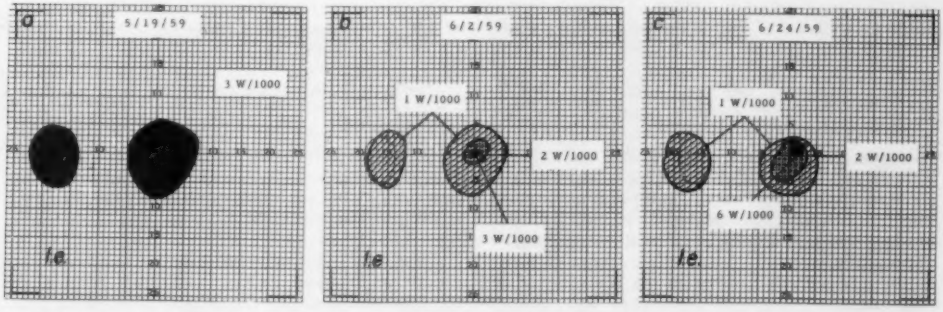

Fig. 3 (Giles and Falls). *Case 3,* central fields, left eye (a) prior to treatment, (b) at the completion of amphotericin-B therapy and (c) three weeks later.

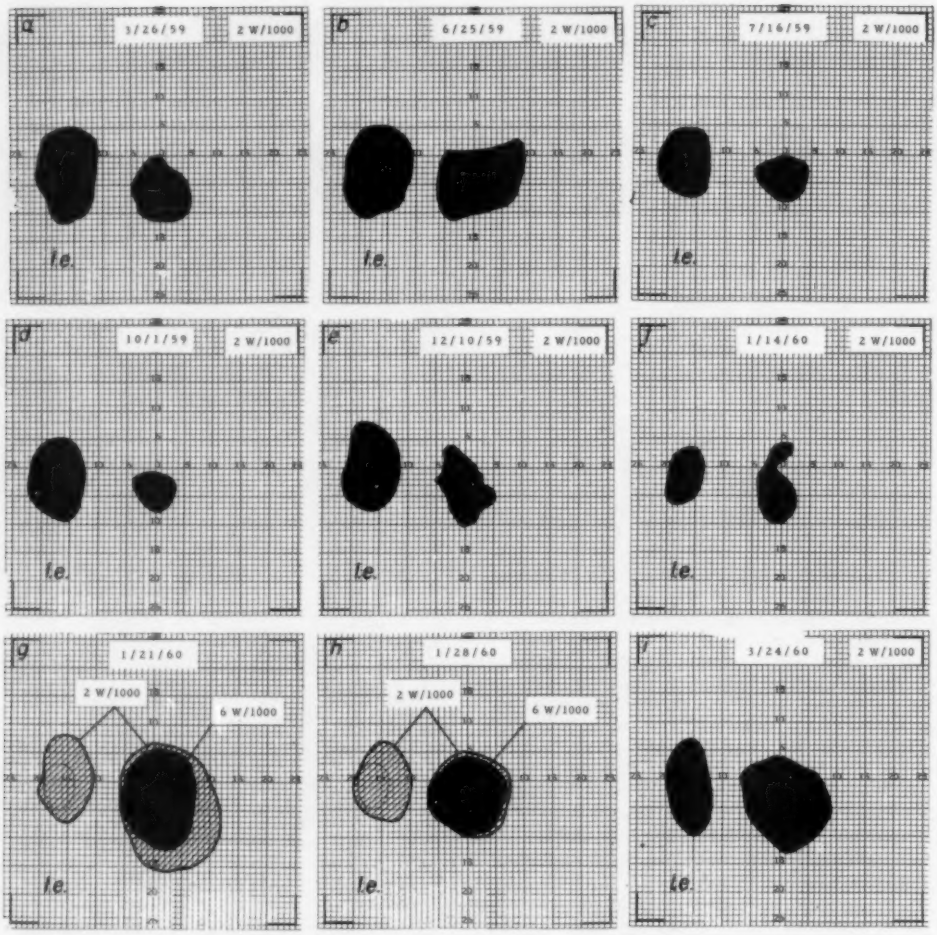

Fig. 4 (Giles and Falls). *Case 4,* central fields, left eye (a) three months prior to amphotericin-B therapy, (b) just prior to therapy, (c) at the completion of treatment, (d) two and one-half months later, (e) five months later and (f) six months later. Steroids were started at this time and one week later the fields were those shown in (g), two weeks later (h) and two months after tapering steroids (i).

Michigan Medical Center on March 26, 1959. He had noted a central scotoma in his left eye two months prior to his visit.

Vision at that time was 20/20, O.D.; 20/25, O.S. The external and slitlamp examinations were normal. Disseminated healed chorioretinal lesions were seen in both eyes and in the left eye an edematous, scarred perimacular lesion with a collarette of hemorrhage inferiorly was present. A small paracentral scotoma was plotted on the Bjerrum screen (fig. 4-a).

Diagnosis of disseminated, inactive chorioretinitis, O.U., and acute central chorioretinitis, O.S., were made.

Pertinent findings in the complete uveitis survey included positive skin tests to old tuberculin histoplasmin and toxoplasmin control. The active toxoplasmin antigen was negative. Calcified nodes and pulmonary scarring were noted in the chest X-ray films. A Sabin-Feldman dye test was 1:64 and histoplasmin complement fixation was negative in antigen 1 and positive 1:8 in antigen 2.

In spite of the positive old tuberclin and low positive Sabin-Feldman dye titer and chiefly because of the macular lesion plus the positive complement fixation studies to histoplasmin, the patient was admitted for amphotericin-B therapy on June 25, 1959. The vision on the day of admission had

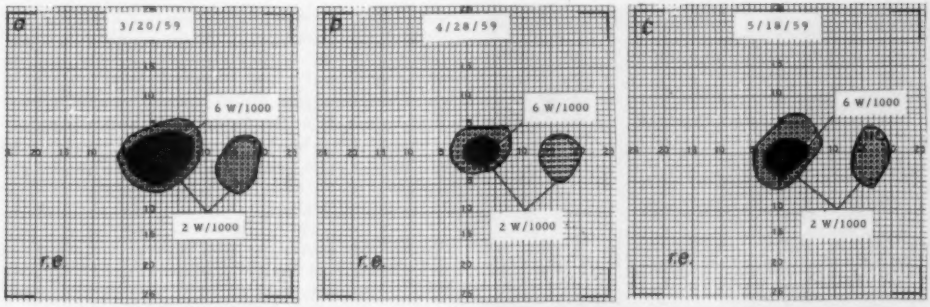

Fig. 5 (Giles and Falls). *Case 5*, central fields, right eye (a) prior to amphotericin-B therapy, (b) at the completion of treatment and (c) three weeks later.

dropped to 20/25—, increased perimacular hemorrhage was seen and the paracentral scotoma had enlarged when compared with the previous examination (fig. 4-b).

The patient received 1.0 gm. of amphotericin-B intravenously over a period of 21 days in 20 divided doses. During therapy the blood urea nitrogen rose to 25 mg. percent and the BSP retention to 8.0 percent. The patient noted chills and fever but generally tolerated the drug quite well.

Less hemorrhage was noted in the macula as treatment progressed and one week following completion of therapy the vision was 20/20— and the paracentral scotoma had receded further from the fixation point. He was discharged on sulfadiazine 1.0 gm. (o) q.i.d. to be used for three weeks.

The patient's vision vascillated between 20/20— and 20/30+ over the next five months. Eventual complete resolution of the macular hemorrhages occurred. On December 10, 1959, the vision dropped to 20/50 and new macular hemorrhages appeared (fig. 7). A repeat complement fixation study was drawn at that time and the patient was placed on sulfa once again. The patient was next seen on January 14, 1960, when the vision was still 20/50 and the lesion was unchanged. The report on the blood of December 10, 1959, had been received and was negative for histoplasmosis antigens 1 and 2. Because of this finding further treatment with amphotericin-B was deemed inadvisable and steroids in the form of Decadron (6.0 mg. daily for one week) were instituted. The patient was seen one week later and a drop in acuity to 20/400 was found and a definite increase in macular hemorrhage was observed. Steroids were continued for another week and when, on January 28, 1960, after two weeks of corticosteroid therapy, no change was seen in the fundus or in acuity (20/400), it was decided to taper the Decadron and continue treatment with sulfadiazine alone.

The vision rose to 20/200 on March 24, 1960, and was then unchanged on May 19, 1960. The lesion was quiescent at the time of the last examination and no further treatment was instituted. When seen again on October 15, 1960, the visual acuity was 20/30 and the lesion was inactive.

CASE 5

C. T. (registration number 651643), a 52-year-old white man, was first seen in the University of Michigan Medical Center on March 20, 1959. He gave a history of choroioretinitis dating back to November, 1954, at which time old, inactive chorioretinal lesions were noted by his ophthalmologist. In December, 1958, hemorrhage was noted in the area of an old perimacular lesion in the right eye and Decadron (6.0 mg. daily) was started with improvement at first followed by a drop in visual acuity to 20/100 and increased activity of the disease in February, 1959. A positive histoplasmin skin test was noted at the time and the histoplasmosis complement fixation was positive 1:8 in antigen 2. The lesion continued to progress in spite of the use of Medrol (32 mg. daily). The patient was referred to University of Michigan Medical Center for further evaluation.

Visual acuity was 20/200, O.D., 20/20, O.S., at the time of the first visit and ophthalmoscopy revealed old, healed disseminated chorioretinitis in each eye with an acute central chorioretinitis in the right eye. The macula in the right eye exhibited a large hemorrhage, surrounding edema with pigment clumping and retinal elevation nasal to the hemorrhage. Slitlamp and external examinations were normal.

The patient was referred to the Internal Medicine Service where the diagnosis of systemic histoplasmosis was entertained. An extensive combined ophthalmologic-internal medicine evaluation yielded the following pertinent results: positive skin test to histoplasmin, toxoplasmin and brucellergin antigens. Right hilar calcification compatible with healed histoplasmosis, positive brucella agglutination 1:640 titer on two separate occasions and a complement fixation to histoplasmosis positive 1:32, antigen 1 and 1:8, antigen 2. In addition to these positive findings a negative tuberculin skin test, hematologic and urine work-up and unrewarding sputum and gastric studies for acid-fast bacillus and histoplasma capsulatum were obtained.

Because of the character of the lesion, a rise in the histoplasmosis complement fixation, positive chest film, negative tuberculin skin test and poor

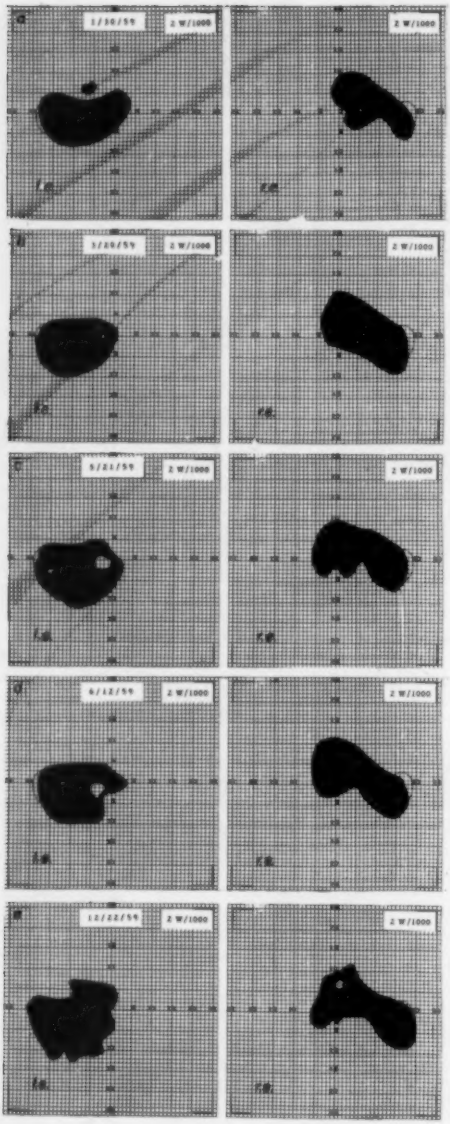

Fig. 6 (Giles and Falls). *Case 6*, central fields, both eyes (a) five months prior to institution of treatment, (b) three months prior to amphotericin-B therapy, (c) just prior to treatment, (d) after receipt of 0.45 gm. of the drug and (e) at the time of completion of intravenous medication.

visual acuity, the patient was admitted to the University of Michigan Hospital. Fifteen 50 mg. doses of intravenous amphotericin-B over a period of 17 days were administered. The BUN remained below 30 mg. percent and no evidence of bone marrow or other complications were noted. The patient requested discontinuance of the drug prior to completion of the total suggested dose of 1.0 gm. because of the unfavorable side-effects of chills, fever, back pain, sweating, muscle aching and general malaise.

No change in the fundus was seen during the therapy but the vision rose from the initial 20/200 to 20/60 at the completion of treatment. The patient was given sulfadiazine (1.0 gm. q.i.d. (o)) at the time of discharge.

On May 11, 1959, three weeks after discharge, the Sabin-Feldman dye titer of 1:8192 was obtained and the patient was started on Daraprim (25 mg. (o) b.i.d.). The vision on May 11th was 20/70+. Next seen on May 18th the vision was unchanged and when last seen, on June 1, 1959, the vision was 20/60—. The patient failed to keep his next appointment.

CASE 6

R.T. (registration number 918400), a 26-year-old man, a student, was first seen at the University of Michigan Medical Center on January 30, 1959, with the history of distorted vision initially experienced while in service in September, 1956. Vision at that time was 20/20+, O.D., and 20/30, O.S. An irregular, slightly raised, grayish, mottled paramacular lesion two disc diameters in size was seen in the left eye. A collarette of macular hemorrhages surrounded the lesion. A diagnosis of acute chorioretinitis, O.S., was made and a complete medical work-up performed was unrevealing. No treatment was given.

In January, 1957, a drop in acuity to 20/80, O.S., was recorded and a decrease in the number of retinal hemorrhages was observed. Again, no treatment was given.

In March, 1959, he was seen by another consultant who found a similar process beginning in the right eye. Meticorten was prescribed and later discontinued because of a lack of response.

From March, 1957, until January, 1959, the condition stabilized and in January the vision was recorded as 20/25, O.D., and 20/100, O.S., with no change noted in either eye compared to the previous examination. The patient then requested consultation at the University of Michigan Medical Center.

Initial examination here on January 30, 1959, revealed a vision of 20/30— O.D., and 20/80, O.S. The slitlamp and external examinations were normal. Ophthalmoscopic examination of the right eye showed an elevated, grayish atrophic area in the macula with surrounding hemorrhages in various stages of resolution. An old, scarred, elevated lesion with slight associated macular edema situated between the disc and macula (involving the edge of the fovea) was seen in the left eye. A diagnosis of active central chorioretinitis, O.U., was made.

Positive results in the uveitis work-up included positive histoplasmin and toxoplasmin skin tests, a positive Sabin-Feldman dye test in the 1:32 dilution and a positive histoplasmosis complement fixation 1:8 in antigen 1. A negative chest roentgenogram was also reported.

The next examination was performed on March 20, 1959. Vision was 20/80+ O.D., and 20/60—

O.S., with no change noted in the ophthalmoscopic picture.

The patient next returned on May 21, 1959, at which time the vision had dropped to 20/80—, O.D., and 20/60—, O.S. He was advised to enter the hospital for amphotericin-B therapy.

This patient tolerated the intravenous therapy as poorly as any individual in the series. From June 2nd to 6th he received 0.25 gm. and because of a rise in the BUN to 47 mg. percent treatment was halted, and the patient discharged. He re-entered the hospital June 15th and through June 18th received an additional 0.20 gm. of the drug, stoppage again being necessitated because of a rise in BUN to greater than 30 mg. percent. The vision on June 12, 1959, had risen to 20/60—, O.D., and 20/40—, O.S.

Over the next five months the patient entered the hospital on four occasions and received an additional 0.45 gm. of amphotericin-B to bring the total amount received up to 0.9 gm. Each time a rise in the blood urea nitrogen was the cause for cessation of treatment. In addition to the rise in BUN the patient experienced chills, fever and anorexia while receiving the drug. The visual acuity at the completion of treatment was 20/100—, O.D., and 20/40, O.S., all hemorrhages had resolved and no sign activity was present. The complement fixation to histoplasmosis had reverted to negative on November 27, 1959, and it was decided to stop all attempts at further therapy and follow the patient closely.

On December 22, 1959, the vision was 20/100, O.D., and 20/40+, O.S., and on May 23, 1960, the vision had risen to 20/60+, O.D., and 20/30, O.S.

Discussion

The infusion of any potentially dangerous drug should not be lightly undertaken. Careful supervision necessitating hospitalization and serial laboratory determinations are necessary during the employment of amphotericin-B.

The fact that cultural isolation of histoplasmin organisms from the eye is still forthcoming makes it all the more imperative that one properly select and carefully analyze all cases of chorioretinitis suspected of histoplasmosis origin.

It is striking that examination of the six cases in this series revealed visual acuity improvement in all but one (Case 4) follow-

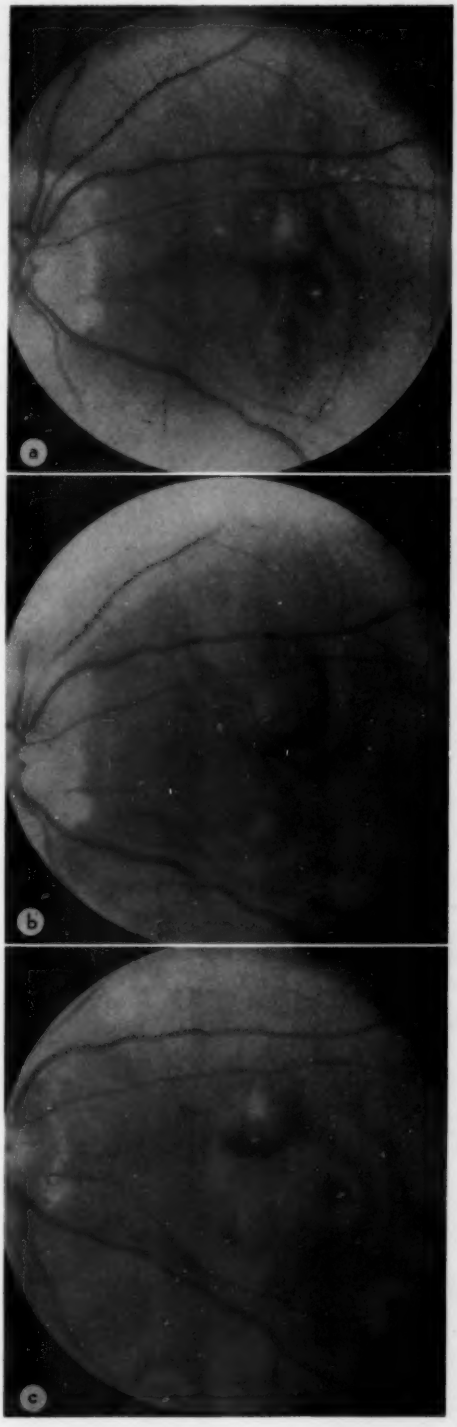

Fig. 7 (Giles and Falls). *Case 4*—Fundus photographs, left eye. (a) December 10, 1959, at the time of reactivation of central chorioretinal disease. (b) February 26, 1960, after two weeks of Decadron therapy and (c) April 21, 1960, six weeks after discontinuing corticosteroid treatment. Note the great increase in hemorrhages following the use of systemic steroid administration.

TABLE 2

TOTAL AMPHOTERICIN-B THERAPY, PERIODIC VISUAL ACUITIES AND DURATION OF FOLLOW-UP AFTER COMPLETION OF TREATMENT

Case No.	Name	Total Amphotericin "B" Therapy gm.	Visual Acuity Initial	After Rx	Final	Follow-up Period
1	B. J. T.	1.0	OS 20/40−	20/20−	20/20−	5 mo.
2	N. F.	0.85	OS 20/80	20/40−	20/40	5 mo.
3	R. G.	1.0	OS 20/200	20/70	20/60	2 wk.
4	G. S.	1.0	OS 20/25−	20/20	20/200	11 mo.
5	C. T.	0.75	OD 20/200	20/100	20/60−	3 mo.
6	R. T.	0.90	OD 20/80 OS 20/60	20/60− 20/40−	20/60+ 20/30	7 mo.

ing amphotericin B treatment. Four of these five cases (2, 3, 5, 6) had previously received unsuccessful steroid therapy. The sixth patient (Case 4) did well for five months after completion of the treatment, then reactivated his disease and, after institution of steroids, the visual acuity further degenerated.

The patients all exhibited positive complement fixation titers which we feel is a prerequisite to giving treatment. Three (Cases 1, 4, 5) out of the six presented with rising titers which is further evidenced of histoplasmosis activity. No patient in this series showed active pulmonary disease.

Most authorities[4,7] feel that any titer 1:8 or greater in either antigen is indicative of histoplasmosis activity with a rising titer considered an even more reliable index. In the absence of active systemic or pulmonary histoplasmosis and with known uveal inflammatory disease we feel that an elevated complement fixation titer may well point to an ocular focus of infection.

As previously mentioned a negative tuberculin and a chest compatible with old granulomatous infection would be helpful in making a diagnosis of ocular histoplasmosis but their absence does not exclude this possibility.

An analysis of the cases using three of the four of Woods' criteria for making a diagnosis of presumptive histoplasmosis chorioretinitis—positive immunologic tests, anergy to tuberculin and pulmonary calcification—were fulfilled in Cases 1, 2, 3 and 5. All four criteria, including the exclusion of other known factors causing uveitis, were met only in Cases 1 and 2.

Cases 3 and 5 both failed to meet the criteria calling for exclusion of all known uveitis-causing etiologic agents because of positive Sabin-Feldman dye titers.

Case 4 showed a rising titer to histoplasmosis complement fixation and calcification in the lung but also demonstrated a positive Sabin-Feldman dye titer and a positive tuberculin skin test.

The last case (Case 6) was found to have a negative chest film and tuberculin test, positive Sabin-Feldman dye titer and a positive histoplasmosis complement fixation, thus fulfilling only two of the four of Woods' criteria (tuberculin anergy and a positive immunologic test).

The clinical picture must be added to any criteria for selection of patients. The uveal manifestations in this group seem to follow a distinct pattern with the lesions located in or near the macula and exhibiting a round, elevated, often cystlike appearance, with a greenish-gray hue. When active, a collarette of hemorrhage and/or edema surrounds the involved area.

Woods and Wahlen[5] first described and photographed this uveal picture and suggested a hypersensitivity reaction to histoplasmosis as its most probable cause. This may be true in a number of cases but, if it were true in all patients exhibiting this fundus picture, one would expect good results from the use of steroid therapy. Such has

not been the case in this series where all patients so treated either showed no improvement (Cases 2, 3 and 6) or further progression of their uveal disease (Cases 4, 5). The hypothesis of a pure hypersensitivity reaction would therefore seem untenable in those cases presented. It may be that the uveal reaction itself is a hypersensitivity reaction to a focus of active fungus infection elsewhere in the body or in the eye and in order to treat the ocular manifestation it is necessary to eliminate the focus with specific antifungal therapy. This presumably is what is accomplished with amphotericin-B. The use of steroids combined with amphotericin-B may eventually evolve as the treatment of choice but in order to determine as well as possible the place of amphotericin-B in ocular therapy we have not attempted to combine treatment to date.

With the use of amphotericin-B certain previously mentioned side-effects—chills, fever, general malaise—occur. These all evoke a stress response and could result in a large endogenous steroid production. Preliminary studies[8] on two patients indicate, however, that the urinary steroid excretion is not significantly increased during amphotericin-B treatment.

One very disturbing factor in the cases presented is the occurrence of positive Sabin-Feldman dye titers in four of the six patients. Although 25 percent of the normal adult population[6] exhibits positive dye titers, a positive test cannot be ignored when it is coupled with a chorioretinal inflammatory lesion. None of the three patients with titers below 1:256 (Cases 3, 4, 6) received antitoxoplasma therapy and all showed significant improvement following the use of amphotericin-B. The fourth patient (Case 5) with a positive Sabin-Feldman dye titer (1:8192) received daraprim and sulfa several weeks after completion of amphotericin-B therapy with no visual improvement beyond that which occurred following his intravenous treatments.

The presence of a measurable dye titer indicates the occurrence of past or present toxoplasmosis infection but does not necessarily mean that this infection is intraocular. Because of this fact and because the clinical lesions were unlike those ordinarily ascribed to toxoplasmosis we have chosen to disregard titers below 1:256 in deciding upon therapy in this group of patients.

In summary, therefore, those patients who exhibited the hypothecated histoplasmosis fundus lesion, with macular or impending macular destruction, and showed serologic evidence of histoplasmosis were treated with amphotericin-B. Most often this group demonstrated calcification in the lungs and negative tuberculin skin tests, though neither of these factors was a requisite for treatment.

The regimen previously outlined[1] has not been greatly modified, although it is now felt that in order to eliminate all possible extraneous factors in evaluating amphotericin-B steroids should be omitted from the program.

Summary and Conclusions

1. A short-term follow-up on six patients treated with amphotericin-B, who exhibited an unusual central chorioretinitis and positive complement fixation titers to histoplasmosis, is presented. Immediately following therapy all of the patients showed improvement in vision.

2. Final follow-up examination in five of the six patients revealed maintenance of this improved vision. The period of follow-up varied from two weeks to 11 months. The sixth patient did well for six months and then reactivated his disease.

3. Although amphotericin-B is a potentially dangerous drug, the encouraging results reported herein indicate that its use is warranted in selected cases of macular chorioretinitis where histoplasmosis is a possible etiologic agent.

4. The criteria for treatment and management of these patients are carefully outlined and discussed.

University Medical Center.

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EFFECT OF ALPHA CHYMOTRYPSIN ON THE CORNEA*

M. Radnót, M.D., and R. Pajor, M.D.
Budapest, Hungary

Changes of the cornea in cataract extractions carried out with alpha chymotrypsin zonulolysis, prompted us to investigate the effect of the enzyme on the cornea. Observations on clinical cases with late reformation or recurring flatness of the chamber and presence of corneal opacities in the region of the wound inspired experiments in rabbits on the effect of the enzyme on the different tissues of the eye. Our first cases were reported in 1959 Radnót and Pajor. Appelmans, et al., investigating whether alpha chymotrypsin produces dislocation of the lens, observed that the enzyme caused opacity (bulla on the cornea) at the site of injection into the chamber. This observation prompted them to investigate the effect of the enzyme on the cornea. Our first observations were similar to those of Appelmans, et al., who suggested DFP as an antidote.

We have now studied the changes in the cornea more thoroughly. A total of 70 animal experiments have been carried out, using a 1:5,000 dilution of the enzyme (Quimotrase) and alpha chymotrypsin (Lerquin).

From these experiments, the following conclusions may be drawn:

The 1:5,000 dilution of alpha chymotrypsin used in zonulolysis affects neither the epithelium nor the endothelium of the cornea. In cases of epithelial or endothelial deficiency, contact of the enzyme with the corneal substance institutes clearly perceptible changes in the corneal fibers; administered directly between the corneal lamellae, it causes swelling of the substance of the cornea. Smaller amounts of the enzyme loosen the substance and dissolve the fibers. Figures 1, 2, and 3 show the different degrees of dissolving, that is disappearance of the fiber substance.

Histologic sections were prepared of dif-

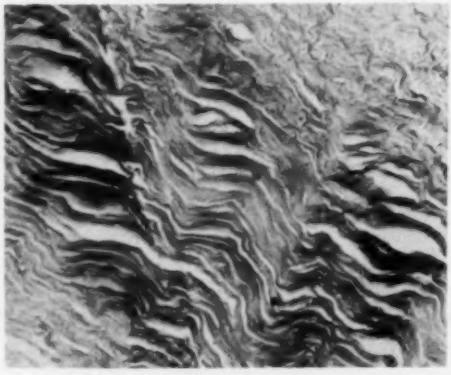

Fig. 1 (Radnót and Pajor). Slightly damaged cornea (Mallory stain).

* From the I. Department of Ophthalmology, University Medical School.

ferent parts of the same rabbit cornea. In Figure 1, numerous fibers can be seen; in Figure 2, the number of well-stained fibers is diminished; and in Figure 3, well-stained fibers have disappeared.

The rabbit cornea between whose lamellae the enzyme had been administered is illustrated in Figure 4. The picture shows that regression of the initial marked swelling has already started. The epithelium protruding into the swollen cornea indicates the site where there had been mushroomlike bulging from the surface. Not only is the substance swollen but the number of fibers have also diminished.

Figure 5 shows the circumscribed area damaged by the enzyme in which the original corneal substance no longer can be identified. This also is in a state of regression. The epithelium protruding into the substance at this site also indicates the limit of the swollen cornea. Following injection of the greater amounts of enzyme, the cornea dissolves entirely and the iris prolapses.

These changes develop within a few hours. After 24 hours there is no progression; actually regression sets in. During recovery a scarcely perceptible inflammatory reaction occurs; however, even in severe cases no significant inflammatory symptoms appear. In eyes in which prolapse of the iris oc-

Fig. 2 (Radnót and Pajor). Corneal segment damaged to a lesser degree (Mallory stain).

Fig. 3 (Radnót and Pajor). Marked enzymatic effect (Mallory stain).

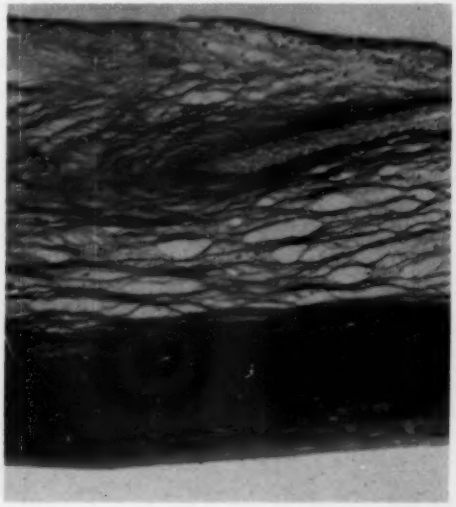

Fig. 4 (Radnót and Pajor). Enzyme injected between the superficial corneal lamellae produces swelling of the lamellae, pushing them aside. Bowman's membrane is well seen.

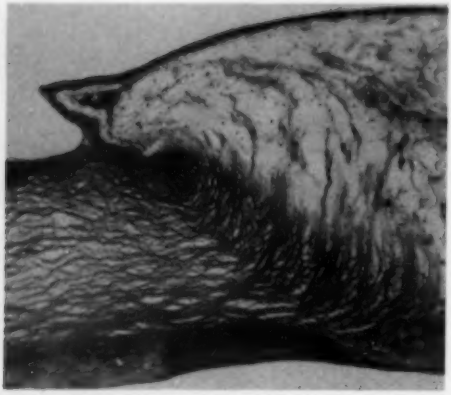

Fig. 5 (Radnót and Pajor). Greater amounts of the enzyme dissolve the corneal lamellae. Limit of intact corneal segment and that affected by the enzyme.

curred, hemorrhages of the iris and ciliary body can be observed; some days later, there were signs of moderate inflammation. Such gross changes had not been observed in our clinical cases.

Investigations were carried out on whether injecting the enzyme into the chamber affects the cornea. Injecting the enzyme into the chamber through a lancet wound caused an opacity corresponding only to the wound, provided it reached between the lips of the

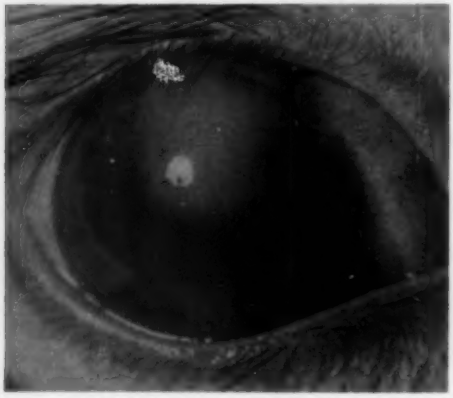

Fig. 6 (Radnót and Pajor). After injuring the posterior surface of the cornea with a spatula, alpha chymotrypsin, injected into the chamber, produced circumscribed opacity.

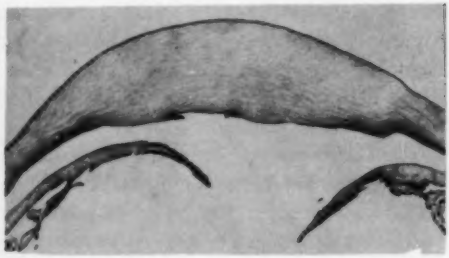

Fig. 7 (Radnót and Pajor). Histologic picture of same case as shown in Figure 2. The cornea has swollen to three times its original thickness.

wound. On the other hand, if the endothelium (Descemet's membrane) was scraped off, circumscribed corneal opacity occurred (fig. 6). The cornea showed uniform swelling at this site (fig. 7). It also lost its metachromasia. This phenomenon occurs in every case of swelling (Ashton).

Swelling of the corneal parenchyma due to the enzymatic effect was also observed by Appelmans, et al., who reported that, following abrasion of the epithelium, drops of alpha chymotrypsin produce great "bullae" and that DFP administered simultaneously

Fig. 8 (Radnót and Pajor). Alpha chymotrypsin injected into the center of the cornea produces colliquation of the lamellae. The markedly swollen cornea became a stringy mass, the limit of which toward the intact corneal segment is clear-cut.

with the enzyme inhibits this effect. These authors are of the opinion that a protective effect is exerted by Descemet's membrane.

If greater amounts of the enzyme are introduced into the cornea, a large stringy mass is created at the injected area (fig. 8) the borders of which are distinct.

Until now, alpha chymotrypsin has been administered in 180 clinical cases and 70 rabbit experiments have been carried out. On the basis of these observations, it must be stated that alpha chymotrypsin has no selective effect on the zonule. When the enzyme dissolves the corneal fibers, considerable swelling sets in and the substance of the cornea may colliquate. The endothelium protects the cornea against this effect. Although we believe that enzyme zonulolysis is a significant advance in cataract extraction, we must emphasize, however, that the enzyme should be washed out carefully and operating techniques must avoid injury of other tissues by the enzyme.

Summary

Alpha chymotrypsin produces marked changes in rabbit cornea, indicating that the effect of the enzyme is not selective for the zonular fibers. Corneal opacity and disorders of wound healing may be due to this. Although the use of alpha chymotrypsin is a significant advance in cataract extraction, injury of other tissues must be avoided.

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STUDIES ON THE MECHANISM OF THE WATER DRINKING TEST*

Miles A. Galin, M.D., Futaba Aizawa, M.D., and Irving Baras, M.D.
New York

In an effort to evaluate the mechanism of the water provocative test, recent studies have been carried out assessing the effect of blood osmolality reduction on intraocular pressure in normal adults.[1] Following the rapid ingestion of one liter of water, blood osmolality is reduced, and a statistically significant increase in intraocular pressure occurs, though less than 6.0 mm. Hg. Moderate variability in outflow facility occurs, while a statistically significant increase in ocular volume results.

Several authors have commented on the importance of 6.0 to 7.0 mm. Hg being the upper limit of normal in interpreting the results of a water drinking test.[2–4] In an average-sized adult human, a reduction in blood osmolality of the order of eight milliosmoles occurs following ingestion of one liter of water.[1] If, as has been stated, the sequence of events leading to an increase in intraocular pressure following water ingestion is initiated by altered blood osmolality, then for a given pressure and outflow facility level, an increase in intraocular pressure greater than 6.0 mm. Hg should occur if blood osmolality could be reduced further.[5]

It is the purpose of this communication to evaluate the response of intraocular pressure to blood osmolality reduction in the range of 20 milliosmoles.

Materials and Methods

The subjects for these studies were trained

* From the Department of Surgery (Ophthalmology) of the New York Hospital-Cornell Medical Center. Aided in part by grants from the National Society for the Prevention of Blindness and the National Council to Combat Blindness.

TABLE 1

INTRAOCULAR PRESSURE RESPONSE IN DOGS TO A REDUCTION IN BLOOD OSMOLALITY OF THE ORDER OF 20 MILLIOSMOLES

Initial Intraocular Pressure (mm. Hg)		Minutes				Maximum Milliosmole Reduction
		15	30	45	60	
A	R 18	28	35	40	40	21
	L 20	26	32	36	40	
B	R 18	23	35	36	41	17
	L 18	23	35	31	32	
C	R 20	27	34	30	38	13
	L 22	19	42	34	33	
D	R 22	28	39	38	38	23
	L 19	23	29	31	33	
E	R 27	31	33	37	39	11
	L 28	32	34	39	30	
F	R 21	28	42	44	42	24
	L 18	28	46	48	46	

female dogs in the weight range of 25 kg. The dogs had free access to water but received no solid food for 12 hours preceding the study. This regime virtually eliminated regurgitation of the water. Tepid tap water, in doses of 30 and 60 cc. per kg., was introduced by stomach tube after multiple weight readings of intraocular pressure were obtained with a Schiøtz tonometer. All animals were given 60 cc. per kg. of isosmotic saline, as well as the various dosages of water. Though it is recognized that the flat dog cornea is not suitable for routine Schiøtz tonometry, the comparative data utilizing the same instrument is of value.

After the water or saline ingestion, the dogs were fastened to an animal table. Cannulization of the internal carotid and femoral arteries was carried out, as well as catheterization of the bladder. Blood samples for cryoscopic analysis were obtained at 15-minute intervals, and the samples subsequently analyzed with a Fiske osmometer. Intravenous solutions of hypotonic urea and hypotonic dextrose were administered to those animals receiving 60 cc. per kg. of water per os to assure reaching and maintaining a large reduction in blood osmolality.

The prewater figure for blood osmolality is the average of a large series of dogs maintained in conditions similar to this study.

RESULTS

Table 1 summarizes the results obtained in dogs given 60 cc. of water per kg., per os, and receiving hypo-osmolar solutions intravenously. It will be noted that blood osmolality was reduced approximately 20 milliosmoles, and intraocular pressure increased approximately twofold.

Table 2 summarizes the results obtained in dogs given 30 cc. of water per kg., per os. These are the same animals included in the study above, so that the comparison is obvious. It should be noted that an increase in intraocular pressure results, though of small magnitude.

Table 3 lists the results obtained when isotonic saline, 60 cc. per kg. was administered per os. No significant alteration in intraocular pressure results.

Figures 1 and 2 compare graphically the intraocular pressure response following varied volumes of water and isosmotic saline in two animals.

DISCUSSION

Recent studies have clearly shown that the

TABLE 2

INTRAOCULAR PRESSURE RESPONSE IN DOGS TO 30 CC. OF WATER PER KG. PER OS

	Initial Intraocular Pressure (mm. Hg)	Minutes				Maximum Milliosmole Reduction
		15	30	45	60	
A	R 23	25	27	25	22	5
	L 23	24	26	24	21	
B	R 19	28	25	25	25	9
	L 16	26	25	25	20	
C	R 24	24	26	24	20	4
	L 23	24	26	24	20	
D	R 25	29	28	25	22	3
	L 25	28	28	25	20	
E	R 16	21	24	24	22	9
	L 17	21	22	21	22	
F	R 26	24	25	24	22	6
	L 29	24	25	24	23	

normal eye responds with changes in intraocular pressure to alterations in blood osmolality of an acute nature.[1,5,6] The response in the glaucomatous eye is even more dramatic, as would be deduced from study of a Friedenwald nomogram. Though a variety of explanations have been offered for the elevation in intraocular pressure following water ingestion, it appears that a reduction in blood osmolality is at least the initiating mechanism. The transfer of water alone, induced by the osmolality change, is probably sufficient to explain the intraocular pressure alterations, though this has not been proved.

The tendency toward a linear relationship between reduced blood osmolality and increased intraocular pressure is well demonstrated by this study. Saline, which causes little change in blood osmolality, caused little change in intraocular pressure. Large doses of water altered blood osmolality and intraocular pressure significantly more than small doses. A similar study has been carried out in the human, and though the results tend to

TABLE 3

INTRAOCULAR PRESSURE RESPONSE IN DOGS TO 60 CC. OF ISOSMOTIC SALINE PER KG. PER OS

	Initial Intraocular Pressure (mm. Hg)	Minutes			
		15	30	45	60
A	R 19	18	18	18	17
	L 17	18	19	18	17
B	R 20	18	18	18	16
	L 21	20	18	16	15
C	R 19	21	19	20	19
	L 21	23	22	19	20
D	R 20	20	20	17	19
	L 21	24	23	22	21
E	R 24	28	27	26	25
	L 27	29	28	28	27
F	R 23	23	19	22	24
	L 24	23	25	23	23

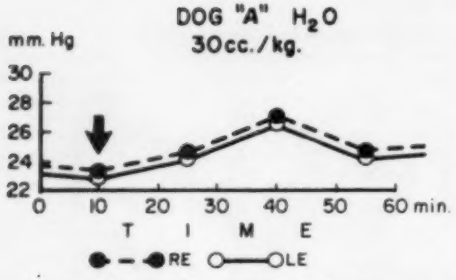

Fig. 1a (Galin, Aizawa and Baras). Intraocular pressure response following 30 cc. water per kg. per os in dogs.

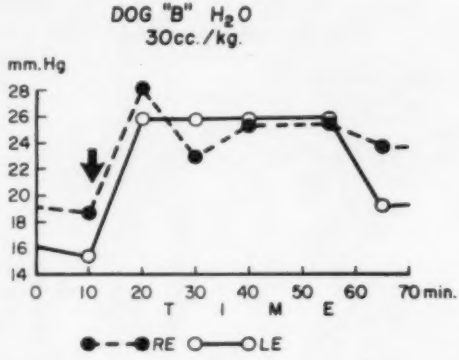

Fig. 2a (Galin, Aizawa and Baras). Intraocular pressure response following 30 cc. water per kg. per os in dogs.

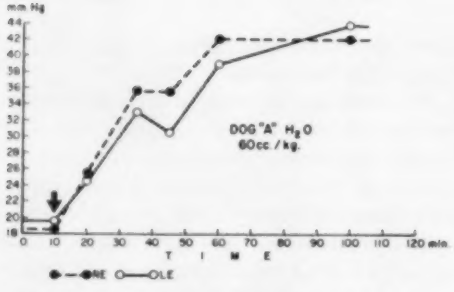

Fig. 1b (Galin, Aizawa and Baras). Intraocular pressure response following 60 cc. water per kg. per os and hypotonic infusions in dogs.

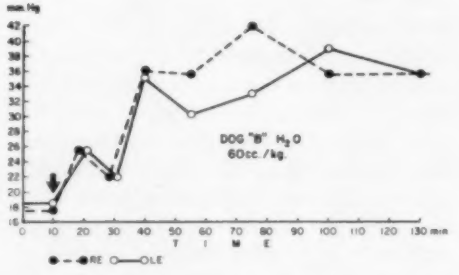

Fig. 2b (Galin, Aizawa and Baras). Intraocular pressure response following 60 cc. water per kg. per os and hypotonic infusions in dogs.

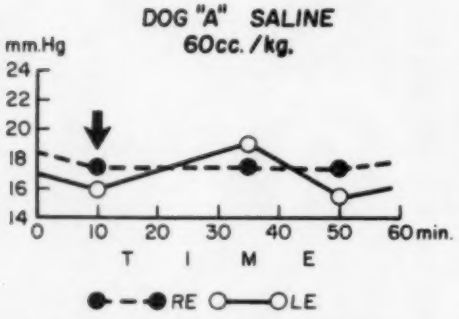

Fig. 1c (Galin, Aizawa and Baras). Intraocular pressure response following 60 cc. isosmotic saline per kg. per os in dogs.

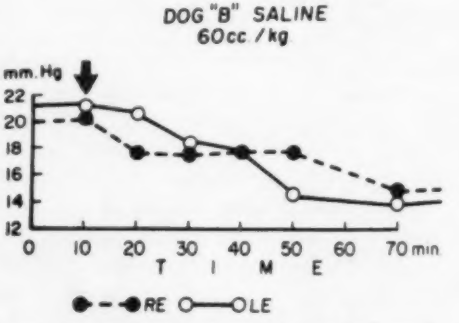

Fig. 2c (Galin, Aizawa and Baras). Intraocular pressure response following 60 cc. isosmotic saline per kg. per os in dogs.

be similar, the inability to administer large doses of water militates against a specific conclusion.[7]

The findings of this study help explain the variability of the water provocative test in humans. Water absorption from the stomach is a variable and complex process. Though the range of reduction in blood osmolality is relatively constant, a moderate variability in the absolute value occurs. Since only a small change in blood osmolality is necessary to induce water transfer sufficient to increase intraocular pressure in the glaucomatous eye, the incidence of a positive test in this population is quite high. In the normal population, and particularly in that group where the intraocular pressure level is suspicious of glaucoma, a false-positive response is obtainable if an unusually large reduction in blood osmolality occurs. Conversely, a rather small reduction in tonicity may lead to a negative test. The use of 6.0 mm. Hg as a clinical level would have far more validity if one could measure osmole changes concomitantly.

525 East 68th Street (21).

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PSEUDOTUMOR CEREBRI SYNDROME*

Following unilateral radical neck dissection

William G. Marr, M.D., and Robert G. Chambers, M.D.
Baltimore, Maryland

It is not generally known that following unilateral radical neck dissection there may develop a symptom-complex suggesting pseudotumor cerebri. It is the purpose of this paper to report two such cases.

The so-called "radical neck dissection" has become standardized as to technique, indications for operation and possible complications. The operation as described by Crile[1] almost 40 years ago has been refined only slightly to include en bloc resection of the primary tumor, as well as the lymphatic tissues of the neck. The operation is designed to remove all possible lymphatic tissue encased between recognized fascial planes, the superficial and deep cervical fascia. The boundaries of the dissection are rigidly fixed and, unless encroached upon by malignant disease, adhered to.

The superior border of the excision is the horizontal ramus of the mandible, that portion of the parotid gland inferior to the main trunk of the facial nerve, the roof of the jugular fossa and the mastoid bone. The posterior border is the trapezius muscle and the inferior boundary is the clavicle. Anteriorly, the dissection includes the submental space and follows the midline of the neck to the sternum. The anterior excision may or may not include resection of the strap muscles and thyroid lobe, depending upon the extent of the disease. Deep margins of the dissection extend to the scalene, erector

* From the Wilmer Ophthalmological Institute of The Johns Hopkins University and Hospital.

spinae and levator scapulae muscles and superiorly to the mylohyoid muscles.

The block of tissue so removed includes the major lymphatic tissues of the neck, internal and external jugular veins, spinal accessory and cervical sensory nerves, carotid sheath, the submaxillary salivary gland and a portion of the parotid. Excised also are the sternocleidomastoid and omohyoid muscles and, at times, the digastric and stylohyoid muscles. The dissection proceeds in an orderly manner from the periphery and usually commences in the region of the clavicle.

Care is taken to preserve vital structures if they are not involved with tumor. Every attempt is made to protect the pleura, vagus, phrenic, hypoglossal and lingual nerves, the common and internal carotid arteries, and the brachial plexus.

The possible complications of neck dissection are legion, some serious and others relatively mild. Those usually mentioned are: cosmetic appearance, facial paralysis, injury to the brachial plexus and other vital nerves, muscular disability, air embolism, pneumothorax, leakage of chyle, injury to major arteries, postoperative infection and salivary fistula. The extent of the disease will at times dictate the subsequent appearance of some of these complications.

Vascular complications attributed to neck dissection are principally arterial injury and hemorrhage. Interruption of major venous drainage has long been considered innocuous other than for the rare occurrence of air embolism. Most head and neck surgeons seem confident that venous structures of the neck can be ligated unilaterally or bilaterally with impunity. However, reports are present in the literature of complications following bilateral and rarely unilateral resection of the internal jugular vein.

Sugarbaker and Wiley[2] described five patients who had a unilateral radical neck dissection followed at a later date by a dissection on the opposite side. All five developed congestion of the face or chemosis of the conjunctiva immediately after the second internal jugular vein was ligated and concomitantly there was marked elevation of the spinal fluid pressure. The optic fundi of two of the patients were examined and engorgement of the retinal veins was found. In these five patients the facial congestion lasted from one day to three weeks. These authors also presented another patient whose face became darkly cyanotic and swollen following ligation of the left internal jugular vein only and the spinal fluid pressure went up to 750 mm. H_2O. The vital signs and spinal fluid pressure returned to normal after 150 cc. of spinal fluid were removed. On the seventh postoperative day the patient died of aspiration pneumonia and an autopsy showed no abnormalities in the venous-sinus system of the skull but the opposite side of the neck was not dissected out to determine whether any occlusion of the right internal jugular was present.

Anlyan, Browning, Black, Clifton and Janzen,[3] described a patient who had a left radical neck dissection. When the left internal jugular vein was cut, the breathing became labored and the face purple. Six hours later a right hemiplegia developed and persisted until his death two months later. At autopsy the left parietal and occipital regions of the brain were softened and necrotic, although the arteries supplying these regions were patent. On dissecting the dural sinsuses, the right transverse sinus was found to have only a pinpoint lumen. They concluded that the predominant venous drainage was to the left and, therefore, after the left jugular vein was resected, the patient suffered a sudden block of venous outflow from his brain.

Jones,[4] in 1951, published a paper on increased intracranial pressure following radical neck surgery. He measured the spinal fluid pressure in 11 patients who underwent radical neck dissection, preoperative and postoperatively from two hours to 12 days after operation. All patients had a spinal fluid pressure well within normal limits prior to neck surgery and all had definitely elevated pressures two hours postoperatively.

The ophthalmoscopic findings consisted of retinal venous engorgement and blurring of the disc edges but no overt papilledema was observed in any instance. After 12 days, two patients were dead, two again had a normal spinal fluid pressure, and seven patients still had an elevated pressure.

The cases described thus far were more acute in their onset than the three cases we are reporting.

Case reports

Case 1

After unilateral radical neck dissection patient had brief "black-out" spells, developed bilateral papilledema with flame-shaped hemorrhages and increased cerebrospinal fluid pressure. Metastasis was suspected. Within five months all evidences of increased intracranial pressure had disappeared.

G. F., a 44-year-old white man, in May, 1958, had a right radical neck dissection for a squamous-cell carcinoma of the right side of the tongue. His immediate postoperative course was entirely uneventful and he was discharged eight days after operation. About three weeks after his discharge he occasionally noticed an unsteady feeling while walking. He had two "black-outs" which lasted only a few seconds. He was not troubled by headaches either immediately after operation or later. Two months after operation he visited an ophthalmologist because his vision seemed distorted. The examiner found blurring of the right disc nasally with some flame-shaped hemorrhages nasally and two diopters of papilledema on the left with surrounding flame-shaped hemorrhages. The peripheral field in each eye was normal to a one-degree white test object.

Because of the possibility of an intracranial metastasis or of an unrelated intracranial lesion, the patient was readmitted to The Johns Hopkins Hospital on August 21, 1958. Except for scars from the operation and bilateral papilledema, the general physical examination was normal. The blood pressure was 130/90 mm. Hg. On lumbar puncture the cerebrospinal fluid pressure was 290 mm. H_2O. On right jugular compression the pressure was 290 mm. H_2O while on left jugular compression the pressure was 360 mm. H_2O and on bilateral jugular compression the pressure was 360 mm. H_2O with a prompt fall on release. There were no cells in the cerebrospinal fluid and the protein content was within normal limits. A right cerebral arteriogram showed no abnormalities. X-ray films of the skull showed evidence of a large right transverse sinus and no transverse sinus could be seen on the left. A scanogram was negative. Ventriculography was not performed. The patient was discharged on August 28th.

His eyes were examined again in November, 1958. He had not had difficulty with his vision for about three months. On ophthalmoscopy all of the flame-shaped hemorrhages had disappeared. The right disc was still blurred nasally and the left disc was elevated one diopter. He was last seen in September, 1959, at which time both discs were normal.

Case 2

After unilateral radical dissection of neck for carcinoma of thyroid, this patient suffered black-outs and developed diplopia. She also exhibited bilateral papilledema and retinal hemorrhages. After 11 weeks, the diplopia disappeared. The papilledema had entirely disappeared after six months.

P. P., a 26-year-old white woman, had a right radical neck dissection in August, 1958, for carcinoma of the thyroid. Her blood pressure on admission was 110/70 mm. Hg.

For two weeks after operation she had some brief blackouts when she sat up quickly and for about a month her head would hurt when she would lie down; this was relieved by getting up. Ten days postoperatively she developed diplopia due to a paresis of the right external rectus muscle. Five weeks after operation she had 20/30 vision in each eye with a slight myopic correction and each eye showed three diopters of papilledema with a few surrounding flame-shaped hemorrhages. Visual fields were normal except for slight generalized constriction and marked enlargement of the blindspot.

The diplopia gradually improved and after 11 weeks she no longer had to wear an occluder over one eye. The papilledema did not increase but, after a month, hard exudates appeared in a radial pattern between the disc and macula in each eye. After three months the vision was at 20/40 corrected and the papilledema and exudates were unchanged but the flame-shaped hemorrhages had absorbed. The papilledema began to subside four months after it was first noticed and it had disappeared entirely two months later.

She was last seen in September, 1959, when she was in good health and at which time the best corrected vision was: R. E., 20/40; L. E., 20/30. The hard exudates had disappeared but in each eye the macula appeared slightly atrophic. This was thought to be secondary to the prolonged retinal edema associated with the papilledema. The peripheral fields were normal and there was some enlargement of the blindspot in each eye. An X-ray film of the occipital region showed the transverse sinus on the right side to be well outlined and of good size while no transverse sinus could be outlined on the left.

Case 3

K. S., a 48-year-old white man, in April, 1960, had a right radical neck dissection. His postoperative course was uneventful for approximately one month; then he began to notice double vision in the evening when he was tired. Examination six weeks after operation showed bilateral papilledema and a paresis of the right superior oblique muscle. The diplopia disappeared one month after it commenced and both discs had returned to normal five months after the

papilledema was discovered. X-ray films of the skull showed the right lateral sinus to be well defined, while the left was either absent or rudimentary. His eyes were normal when he was last examined almost one year after his neck operation.

Discussion

The symptomatology of the two patients whose case studies have been given resembles that of pseudotumor cerebri in which condition there is increased intracranial pressure without an intracranial neoplasm. Wagener[5] said the typical cerebral pseudotumor syndrome was characterized by bilateral papilledema, a normal or smaller than normal ventricular system and a cerebrospinal fluid normal except for increase in pressure.

Patients in whom pseudotumor cerebri develops often are under 30 years of age[6] and appear in good health, with a clear mental state. Headache is the most common presenting complaint and Smith[7] found this symptom in 64 percent of his series. Nausea and vomiting are not uncommon. Paralysis of one or both abducens nerves may occur. The amount of papilledema varies and up to 11 diopters of papilledema has been reported.[8] Visual acuity may be affected if the papilledema is severe or is of long duration.

Constriction of the peripheral fields and enlargement of the blindspots may occur. After recovery visual acuity may return to normal or may be permanently reduced from secondary optic atrophy or macular changes secondary to prolonged macular edema. Recovery from pseudotumor cerebri often occurs spontaneously.

Therapy varies widely. In The Johns Hopkins Hospital it has been either no treatment, believing that recovery would ultimately occur, or subtemporal decompression when the severity of the papilledema threatens vision. Elsewhere repeated spinal fluid drainage has been advocated. Restriction of fluids, reduction of salt intake and the administration of Diamox or one of the newer carbonic anhydrase inhibitors have also been suggested.

The etiology of pseudotumor cerebri is in many cases obscure and the subject further confounded by the many different names given to the syndrome. Quincke[9] may have been the first to describe some such cases under the eponym, serous meningitis. Nonne[10] was the originator of the term, pseudotumor cerebri, in 1904, and, interestingly enough, among the cases he reported was one in which the cause of the increased intracranial pressure was found to be a thrombosis of the left transverse sinus in a patient who two years previously had had a left otitis media. Symonds[11] reported similar cases as otitic hydrocephalus and McAlpine[12] preferred the term, toxic hydrocephalus. Dandy[13] referred to the syndrome as intracranial pressure without brain tumor.

In 1931, Symonds[11] used the term, otitic hydrocephalus, to describe cases which usually occur in children who have had a recent aural infection, develop a squint, usually due to a sixth nerve paralysis, and complain of headache. On funduscopic examination papilledema is found and a lumbar puncture in the fully developed state shows the cerebrospinal fluid to be under increased pressure but clear and containing no excess of cells or protein. Symonds at first thought the affection was the result of an excessive secretion from the choroid plexus or defective absorption through the arachnoid villi. In a later article,[14] he agreed that, since the ventricles were normal or smaller than normal, otitic hydrocephalus was a misnomer. After discussing confirmatory evidence, he concluded that dural sinus thrombosis might be responsible for the symptom-complex. He studied several post-mortem cases and found that thrombosis of one lateral sinus alone could produce otitic hydrocephalus, but he was uncertain whether there might have been a contributory anatomic factor, such as a smaller opposite lateral sinus. In three other autopsies he found obstruction to the venous outflow from the level of the torcular. Symonds has pointed out that thrombosis of the inferior petrosal sinus probably explains many cases of sixth nerve paralysis.

McAlpine[12] described cases similar to those

reported by Symonds but they followed a nasopharyngeal infection as well as otitis media and he felt, therefore, that the adjective otitic was better replaced by the word "toxic" which carried a less specific implication as to the causative factor.

Dandy[13] reported 22 cases of what is here termed pseudotumor cerebri under the title "Intracranial pressure without brain tumor." All the patients he put into this category had elevated intracranial pressure, papilledema, normal or smaller than normal ventricles, and sixth nerve palsies were frequently present. In 1954, Zuidema and Cohen[15] published a follow-up report on 12 of Dandy's cases. Ten individuals were living and well while two had died of causes not related to increased intracranial pressure.

Ersner and Myers,[16] in 1936, published a paper suggesting that the etiology of otitic hydrocephalus might be connected with obliteration of a lateral sinus. They briefly described two cases in which signs of increased intracranial pressure developed following obliteration of the right lateral sinus. The symptoms were ameliorated by the use of magnesium sulfate, glucose intravenously and lumbar puncture. They also presented three other cases in detail; X-ray films revealed one large lateral sinus with the opposite sinus much smaller in two of the cases. In the third case the X-ray film of the lateral sinuses was not mentioned. The three patients recovered following spinal drainage and removal of the irritative focus in the mastoid.

Woodhall[17] described the embryology and anatomic variations of the lateral sinuses and contiguous structures and reported the clinical symptomatology of thrombosis of one or more of the venous channels. One of the patients was a 46-year-old man with the history of right otitis media and mastoiditis three months previously. On admission the only neurologic finding was papilledema. Because of increased intracranial pressure a right subtemporal decompression was performed. This was followed by pneumococcus meningitis and death occurred within a week. An autopsy showed the superior longitudinal sinus and the right lateral sinus into which it emptied to contain a partly organized thrombus. The left lateral sinus was patent but in size was less than half the diameter of the right sinus.

Evidence that it is not unusual for the right transverse sinus to be the larger has been supplied by Woodhall.[18] He studied variations of the cranial venous sinuses in the region of the torcular herophili in 100 consecutive autopsies in which the structures had not been damaged. He reported a right-sided predominance, with the larger volume of the superior sagittal sinus directed toward the right transverse sinus and the lesser volume of the straight sinus directed toward the left transverse sinus, in 39 percent of the cases. Left-sided predominance in which the larger superior sagittal sinus emptied into the left transverse sinus and the smaller straight sinus discharged into the right transverse sinus was found in 13 percent. He also found a major disproportion between the transverse sinuses in 24 percent and the absence of one transverse sinus in four percent.

Woodhall[19] later observed that roentgenograms of the occipital region demonstrated relative differences and variations in the size of the bony marking of the transverse sinuses which closely corresponded to his previous anatomic observations. In other words anteroposterior roentgenograms of the occipital bone showed markings due to the transverse sinuses from which it could be determined that the right transverse sinus was the larger with presumed right-sided predominance and that there existed a major disproportion between the sinuses in approximately the same percentages as he found in his autopsy studies.

Ray and Dunbar,[20] by sagittal sinus venography, were able to confirm that thrombosis of one or more of the dural venous sinuses could produce the symptom-complex of pseudotumor cerebri.

The method of dural sinus venography consists of the injection of 35-percent Diodrast into the anterior portion of the superior sagittal sinus via a catheter introduced into the sinus through a small midline burr hole, with appropriate roentgenograms. In the normal, the contrast medium passes backward through the superior sagittal sinus to the torcular herophili and thence through both transverse sinuses into the internal jugular veins. The cerebral veins and other dural sinuses do not fill unless there is some obstruction in the superior sagittal or transverse sinuses.

One of the patients described by Ray and Dunbar[20] was a man who had an earache and purulent discharge from the right ear canal for two weeks. On the day of admission he had developed a high fever (40°C.). Blood culture was positive for Proteus vulgaris. Roentgenograms showed evidence of acute right mastoiditis. A right mastoidectomy was performed and the transverse venous sinus was found to contain an infected thrombus which was not removed. On antibiotic therapy there was rapid improvement of the patient's condition but within a few days he began to experience blurred vision and generalized mild headache. There were about two diopters of papilledema bilaterally and a few small retinal hemorrhages. The neurologic examination was otherwise normal. The spinal fluid pressure was 400 mm. H_2O and the fluid was clear, colorless and accellular. A sagittal sinus venogram showed complete obstruction of the right transverse sinus just lateral to the torcular herophili and a small left transverse sinus. The patient improved gradually and the headache, blurred vision and papilledema subsided steadily and had disappeared after two months.

It was shown that the thrombus was limited to the right transverse sinus while the superior sagittal and the other small transverse sinus were both patent. The development of increased intracranial pressure points to the inadequacy of the remaining small left transverse sinus to compensate for the obstruction of the opposite larger transverse sinus. The subsidence of the signs and symptoms of elevated intracranial pressure were assumed to be due to the development of collateral circulation.

This case resembles the otitic hydrocephalus cases described by Symonds except that the state of good health, excluding the signs of increased intracranial pressure, occurred spontaneously in Symonds' cases while in Ray and Dunbar's case the rapid improvement in the patient's condition before papilledema developed was presumably due to the antibiotic treatment.

Although Ray and Dunbar expressed the hope that sinus venography would show the majority of cases of pseudotumor cerebri to be due to thrombosis of one or more of the dural venous sinuses, additional studies did not support their original supposition. Ray,[21] in 1955, reported that in less than half of the cases could obstruction of venous channels be demonstrated. There still remains a large group for which full explanation is lacking.

An unusual and unexplained occurrence of pseudotumor cerebri has been seen in women in association with generalized edema appearing at the menstrual period. Thomas[22] described two such cases and McCullagh[23] reported one. Both authors attributed the improvement in their patients to hormonal therapy, which suggests an endocrine basis for the disorder.

Conclusions

Following unilateral radical neck dissection for malignancy three patients developed signs and symptoms of increased intracranial pressure and other essential feautures which characterize pseudotumor cerebri. Because a malignant tumor had been excised, the possibility of intracranial metastasis was considered. Spontaneous clearing of the signs eliminated this probability. Since in our patients here reported major venous drainage channels had been obstructed, it seems apparent that this accounted for the development of a picture of pseudotumor cerebri.

This concept is in agreement with studies made by Symonds, Ersner and Myers, Woodhall, and Ray and Dunbar. Our patients had a large transverse sinus according to X-ray films and the internal jugular vein of the same side was ligated. The opposite transverse sinus could not be identified and may well have been small or absent. These case reports supply additional evidence that the interruption of dominant dural sinus drainage may produce the picture of pseudotumor cerebri.

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CONSTRUCTION OF THE UPPER LID FOLD*

JOSEPH AMDUR, M.D.
Miami, Florida

A number of authoritative articles have been written discussing operative technique in the creation of an upper lid fold during ptosis surgery. The authors agree that establishment of the upper lid fold is an important cosmetic factor. There has been little emphasis, however, on the ease with which an upper lid fold can be established in surgical procedures other than in ptosis surgery. It is the purpose of this paper to re-emphasize the many opportunities for creating an upper lid fold available to the ophthalmic surgeon, and to present a simple operative technique.

INDICATIONS

Although much has been written about blepharoptosis, there are other conditions of the upper lid which are seen more frequently by most ophthalmologists. Xanthelasma, senile blepharochalasis and lacerations are common indications for the ophthalmic surgeon to venture into the upper lid. Each of these conditions primarily entails the excision of the upper lid skin and the uniting of wound edges. Although the final cosmetic result would be much enhanced by a good lid fold, little attention is usually given to this feature of the surgical repair.

In the realm of plastic ophthalmic surgery, there are further opportunities for obtaining a better cosmetic result by the creation of an upper lid fold. Any block excision of the upper lid, regardless of the technique used in the repair, involves a skin closure in the region of the lid fold. In cicatricial ectropion of the upper lid, whether the repair is one of free skin graft or sliding skin flap, the surgeon must suture in the region of the upper lid fold. Therefore, there are multiple situations in ophthalmic surgery, other than ptosis surgery, in which the surgeon is faced with the problem of creating an adequate upper lid fold.

MULTIPLE METHODS

In reviewing the literature on ptosis surgery it is obvious there are many methods for the constructing of the upper lid fold.[1-16] The fold is most often created by making a permanent adhesion between the levator and the skin, approximately 8.0 to 12 mm. from the upper lid margin (fig. 1.). The method used in constructing this adhesion varies. Some surgeons pass the sutures to the skin through the entire thickness of the lid from the conjunctival surface (conjunctival route). Others only partially penetrate through the lid with sutures from skin into levator (skin route). Regardless of the route used, each method creates permanent adhesion between the skin and the levator muscle above the upper edge of the tarsus.

When the levator contracts, this adhesion is retracted back in the direction of the orbital roof. The loose skin of the upper lid, from the brow to this adhesion, folds over the retracted skin and levator. This then appears as a horizontal skin fold in the upper lid above the tarsus. Any technique which forms an adhesion between skin and the le-

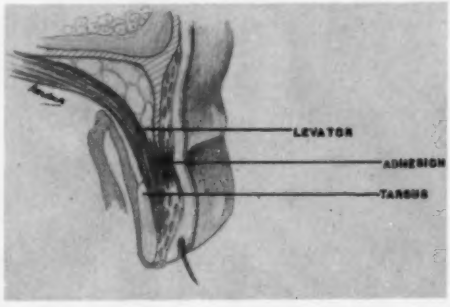

Fig. 1 (Amdur). Cross section, showing resected levator adherent to tarsus, with adhesion between skin and levator producing the upper lid fold.

* From the Ophthalmic Plastic Surgery Clinic, Department of Ophthalmology, Jackson Memorial Hospital.

vator in this region will therefore result in an adequate lid fold.[1]

Conjunctival route

Berke's method[2] is to anchor the resected levator to the anterior surface of the tarsus. Following this a second row of interrupted sutures is placed from the conjunctival surface, through the levator at the upper border of the tarsus. The sutures are tied but the arms are left long in order to place them through the gaping skin incision edges. When they are tied, the skin is united and is made adherent to the levator in the region of the lid fold.

Callahan,[3] in describing the lid fold in internal route ptosis repair, advises passing sutures from the conjunctiva, through levator and skin, 4.0 to 5.0 mm. above the lashes, The sutures are then tied over a rubber strip, producing the required adhesion between skin and levator from the lid fold. In the external approach to the levator, Callahan mentions closing the skin incision with interrupted sutures, and picking up some of the levator fibers with two or three sutures. Stallard[4] also only attaches skin to levator in two places. This is essentially the skin-closure method discussed in this paper, except that in this paper emphasis is placed on picking up levator tissue with each interrupted or continuous suture to make a firm adhesion between skin and levator at the time of the skin closure.

Another method advocated by Callahan,[5] in discussing postoperative failure to gain a lid fold, is a modification of the LeGleyze procedure. Here the sutures are placed from the conjunctival surface, 1.0 mm. above the upper tarsal border, threaded along the anterior tarsus, and brought out through the skin at the level of the lid fold where they are tied. This creates the necessary adherence of skin to the levator in the proper area. Barsky[6] also uses the method of passing sutures through the under surface of the levator into the skin to the level of the lid fold. He does not emphasize skin closure and attachment to the levator in one step.

Other advocates of the conjunctival passage of sutures through the levator are Spaeth[7] and Arruga.[8] They advocate sutures from the conjunctiva, through levator and skin tied externally. Spaeth often ties these sutures over three or four lengths of 4-0 suture placed horizontally on the skin overlying the lid fold.

Schimek[9] states, "If the levator is anchored to the tissues of the upper lid in the proper manner by carefully placed sutures across the anterior surface of the tarsus to emerge about three mm. above the lash line, the natural retraction of the levator will subsequently produce a natural appearing lid fold."

Sayoc[10] advises excising a strip of pretarsal orbicularis, then using buried sutures to anchor the skin directly to anterior tarsal surface. The skin edges are then approximated with interrupted sutures. This introduces an additional step, since the pretarsal fibers could be picked up with each skin closure suture. However, in essence this is the method advocated in this paper. In his paper, Sayoc's use of this closure is limited to the creation of the lid fold in ptosis procedures and those for the oriental upper lid.[11] It has much broader uses.

Fox,[12] in discussing the Blaskovics' method of ptosis repair, also advocates the conjunctival route. He catches up a few anterior tarsal fibers near the cut end with one needle of each mattress suture before it is passed out through the skin surface. Thus the three mattress sutures, when tied, act as a point of anchorage over which the upper lid skin tends to form a fold. Essentially this anchors the skin to the anterior tarsal surface. However, in discussing the external route, he advises closing the skin as follows: the central suture and one near each end pick up a few fibers of anterior tarsus to recreate the lid fold.

A danger inherent in this method is mentioned by Mustarde.[13] In discussing the formation of the lid fold he feels that deep mat-

tress sutures from the conjunctiva through the levator may be a contributing cause to partial failure of the levator resection. The small areas of muscle ischemia and fiber replacement weaken an already malfunctioning levator.

Skin route

Byron Smith[14] advocates creation of the lid fold during the skin closure. He sutures the lower edge of the skin incision to the tarsal surface; then a second line of sutures is placed two mm. from the wound edges. As the second line of sutures is tied, the original incision is invaginated, resulting in a lid fold.

Leabert,[15] in an article on the formation of lid folds in Orientals, separately sutures the lower skin incision to the anterior surface of the levator aponeurosis. However, as a separate step, he then closes the skin with interrupted sutures.

Hughes[16] gives us the simplest and most effective method of creating an upper lid fold (fig. 2). He points out that his method is used not only in ptosis repair but emphasizes its applicability in other forms of surgery involving the upper lid. In discussing lid lacerations he states: "the formation of this fold is not difficult. It is accomplished by taking with each suture a small bit of the deep tissue along a transverse line symmetrical with the line of the fold in the upper lid. If the laceration extends obliquely across the line of the fold or, if there are multiple lacerations, one must be careful to anchor down the sutures in the path of the lid fold so that a smooth fold can be created in the proper location."

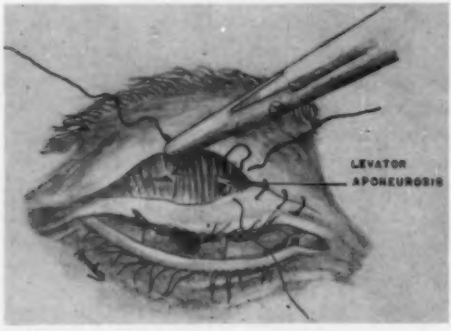

Fig. 2 (Amdur). Method of skin closure to produce an upper lid fold. Levator aponeurosis is taken with each skin suture.

This is the method I am advocating. As Hughes has stated, ptosis and lacerations are indications for this closure. Other indications for this skin closure have already been mentioned in the introduction and need only reemphasis.

Complications

Six other minor points in this technique are worthy of mention. The lower skin incision must not be closer than four mm. to the lateral canthus. If closer, lymphedema of the pretarsal area will occur following anchorage of the lid fold to the levator aponeurosis.

A thickened pretarsal area at the lid margin is a frequent occurrence following surgical construction of the upper lid fold. This is due to anchoring the skin to the tarsus over a roll of subcutaneous fat and orbicularis. Before anchoring the lower skin border, the pretarsal area should be carefully cleaned of these tissues. The lash bulbs should be readily discernible but care should be taken not to injure them or loss of the cilia will result.

A third complication after anchoring the levator to the anterior tarsus is a marked downturning of a number of cilia. This occurs because the tarsus adjacent to this area is everted when a suture is placed too close to the lash bulbs, on the anterior tarsal surface, or the knot is tied too tightly. The lash bulbs are pulled up, resulting in downward displacement of the lash tips in this area.

Often the lid fold, although well formed, may be obscured by redundant skin from the brow overlying the fold. This is really blepharochalasis displaced vertically. Excision of enough redundant skin to give the lid normal downward excursion and yet not to obscure the fold in the primary position can easily be accomplished.

Often following surgery in this area there is a fullness in the upper lid above the level of the lid fold which detracts from the cosmetic appearance. This is due to the herniation of the orbital fat above the globe and the levator through a perforated orbital septum. This can be corrected at the time of surgery, if anticipated, or as a subsequent elective procedure. The herniated fat is excised, with attention to the hemostasis, and the orbital septum is closed.

Finally, Callahan[17] has emphasized that the skin incision must overlie levator, not tarsus. If too close to the lid margin, tying the closure sutures will evert the upper lid margin, resulting in ectropion.

Summary

A method of creating an upper lid fold during skin closure is presented. Multiple common indications for its usage in procedures other than in ptosis surgery are emphasized. The literature relative to this problem is reviewed. Treatment of complications is discussed.

1308 Genoa Street.

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CONOID CATARACT LENSES FOR THE CORRECTION OF APHAKIA*

David Volk, M.D.
Cleveland Heights, Ohio

The successful use of conoid lenses as low-vision reading aids has led to the development of a series of such lenses for the correction of aphakia. These conoid cataract lenses employ ellipsoids of revolution as the front surface and optimally correct the aberrations which are inherent in spherical lenses. The result is a lens with gradually reducing power from center to edge so that to the eye fixating through various zones of the lens, the effective prescription is the

* From the Department of Ophthalmology, Western Reserve University School of Medicine. Presented at the East-Central Section of the Association for Research in Ophthalmology, Inc., Cincinnati, Ohio, January, 1959.

same. Thus there is clear vision from the center to the edge of the lens, practically uniform magnification across the lens, and the absence of the annoying blur and distortion which occurs when objects in the environment pass through the field of the lens.

Blurring aberrations and distortion of spherical lenses†

There are three aberrations which cause blurring of vision when the eye fixates through a peripheral part of a plus lens; curvature of the field (lateral overcorrection), marginal astigmatism, and chromatic aberration. Of the three, lateral overcorrection and marginal astigmatism can be eliminated in cataract lenses by using ellipsoids of revolution as the front surface of the lens. Chromatic aberration will remain when lateral overcorrection and marginal astigmatism are eliminated, since it is dependent upon the dispersion of light by the optical media. It is reduced in a conoid lens as compared to that in a spherical lens of the same effective power, since the amount of prismatic effect in the conoid lens at a particular point is less than that in the spherical lens at a corresponding point. For low-power cataract lenses, both spherical and conoid, chromatic aberration is relatively small, whereas in high-powered cataract lenses chromatic aberration becomes an important factor contributing to the blurring of vision. It is in the high-power cataract lenses that chromatic aberration is significantly less in the conoid than in the spherical lens.

The distortion resulting from the use of spherical cataract lenses is of the pincushioning and concaving types, due to the magnification increasing at a progressive rate from the center to the edge of the lens. With the eye looking straight ahead, there is distortion of objects in the peripheral part of the field as well as blurring of these same objects. The peripheral objects appear enlarged and elongated in a radial direction from the line of sight and appear closer to the viewer. As the objects move into the field of view at the periphery of the lens, they appear enlarged, elongated radially, and blurred, appearing closer to the viewer, gradually clearing towards the center of the lens, and as they continue across the field of view, gradually enlarge, elongate radially, become blurred, and appear to approach the viewer. The same appearance results when the head and eye rotate while the subject views the environment. With the head remaining stationary, and the eye rotating laterally to observe objects through the periphery of the lens, the amount of blurring and distortion is increased. Figure 1A is a photograph taken through a strong plus spherical lens designed to demonstrate the effects of the blurring aberrations and distortion upon the field as seen through the strong plus lens. Figure 1B is a similar photograph for comparison purposes; here the blurring aberrations and distortion are corrected.

The same ellipsoid of revolution which completely eliminates lateral overcorrection and marginal astigmatism, reduces distortion to the point where it is negligible.

Just as the environment appears distorted through spherical cataract lenses, the eye of a patient wearing spherical cataract lenses appears magnified and distorted to an observer looking at the eye through the periphery of the lens. The conoid cataract lens, on the other hand, magnifies the eye almost uniformly and consequently does not produce a distorted appearance of the eye.

Field of view

The extent of the environment which can be seen through a spectacle lens depends upon the size of the lens, its distance from the eye, and the magnification produced by it. The greater the magnification, the smaller the environmental field which is seen through a particular lens when placed in the spectacle plane. Spherical cataract lenses, of necessity, have an increasing rate of magnification

† Volk, D.: Conoid refracting surfaces and conoid lenses. Am. J. Ophth., 46:86-95 (July, Pt. II) 1958.

Fig. 1A (Volk). Photograph taken through a strong plus spherical lens, designed to demonstrate the effect of the blurring aberrations and distortion. Note the clear central area and the progressive blurring from the center to the periphery. The image likewise is magnified progressively from the center toward the periphery, resulting in a distorted image in which peripheral objects are enlarged and elongated in a radial direction from the optic axis of the lens.

from the center to the edge of the lens. The conoid lens, on the other hand, has a nearly uniform magnification across the lens. This means that the field is larger in the conoid lens than in the spherical lens of the same effective power. (Compare figures 1A and 1B.)

Construction of the conoid cataract lens

Single vision conoid cataract lenses are made of crown glass. Conoid cataract bifocals are made of crown glass with a barium crown glass 22-mm. straight-top segment. Since the conoid surface has an apex, the

Fig. 1B (Volk). Photograph similar to Figure 1A without the blurring and distortion. A comparison of Figures 1A and 1B shows the loss of field resulting from the nonuniform magnification of the spherical lens.

Fig. 2 (Volk). Drawing of the cross section of a conoid cataract bifocal showing the position of the barium crown-glass bifocal segment within the crown-glass lens.

bifocal segment must be positioned with respect to this apex, and is set 3.0 mm. below and 1.75 mm. nasal to the apex. The segment is buried within the crown glass; that is, there is crown glass in front of and behind the segment (fig 2). This insures that the reading addition will remain constant, and that the correction of the blurring aberrations, marginal astigmatism in particular, will be corrected for the reading area. Both the crown glass used for the distance correction and the barium-crown glass used for the segment are ideally suited for the conoid cataract lens because of the low chromatic dispersion of both.

Correction of ocular astigmatism with conoid cataract lenses

In order that the aberrations be maximally corrected, it is necessary that each prescription of increasing power have a different front curve. Consequently, conoid cataract lenses are made with front curves which vary in power in steps of 0.25D., with a prescription range from +7.5D. to +24D. Reading additions are available from +1.5D. to +5.0D.

Correction of astigmatism is accomplished in the same way as with spherical cataract lenses. The cylindrical correction is ground on the inner surface of the lens. Since the front conoid surface is designed for a −3.0D. spherical surface on the eye side, the correction of astigmatism is accomplished by dividing the cylindrical correction equally on each side of the −3.0D. base curve. In this way, there is the least departure from the ideal −3.0D. base curve for which the lens has been designed. For example, if there are two diopters of astigmatism, the principal meridians on the eye side will be −2.0D. and −4.0D., straddling the −3.0D. base curve. In actual clinical practice a tolerance is permissible and some departure from the minus 3.0D. base curve is allowed without any significant impairment of the aberration-correcting qualities of the lens. Thus, should a prescription need to be changed, a lens can be reground with slightly different base curves and still do an excellent job of correcting aberrations.

Thickness of conoid cataract lenses

The use of an ellipsoid of revolution as the front surface of the conoid cataract lens results in a thinner lens than an equivalent powered spherical lens. For example, the sagittal depth of a +15D. conoid surface of 45 mm. diameter is approximately 0.2 mm. less than that of a spherical lens surface of the same power. In low-power small-diameter lenses, the difference in thickness between conoid and spherical lenses is slight, whereas in higher powered and larger diameter lenses, there is a significant difference in thickness, so that conoid cataract lenses will be thinner and lighter. Figure 3 shows for a representative series of powers the difference in sagittal depth between conoid surfaces and the corresponding spherical surfaces.

Clinical evaluation of the conoid cataract lens

Acuity measurements across the lens

I have personally prescribed conoid cataract lenses for 68 patients and have evaluated the results of the wearing of the lenses by these patients. When the patient had

Base Curve (diopters)	Lens Diameter (mm)						
	38	40	42	44	46	48	50
11.00	0	0	.1	.1	.2	.2	.2
12.00	0	0	.1	.1	.2	.2	.2
13.00	0	0	.1	.2	.2	.2	.3
14.00	0	0	.1	.2	.2	.2	.4
15.00	.1	.1	.1	.2	.2	.3	.5
16.00	.1	.2	.2	.4	.5	.7	.9
17.00	.3	.4	.5	.7	.8	1.1	1.4
18.00	.3	.4	.5	.7	.9	1.2	1.7
19.00	.4	.5	.7	.9	1.2	1.5	2.3
20.00	.6	.8	.9	1.3	1.7	2.5	3.7

Fig. 3 (Volk). Chart showing the amount in mm. by which conoid surfaces are less in sagittal depth than spherical surfaces of the same refractive powers and the same diameters.

spherical cataract lenses of the same prescription as the conoid cataract lenses, acuity measurements were made through various zones of each type of lens and the results compared. Figure 4 shows graphically the results of such measurements of five typical aphakic eyes which had good acuity. With the conoid lens, visual acuity measured through the periphery of the lens fell slightly toward the periphery of the lens, whereas with the spherical cataract lens, there was a marked fall in acuity, to values as low as 20/400, with an upper limit of less than 20/100.

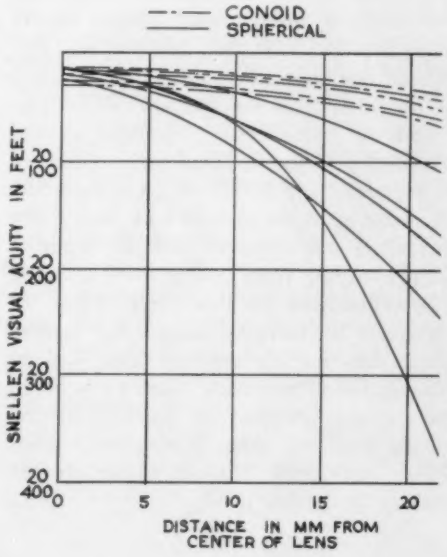

Fig. 4 (Volk). Visual acuity measurements through central and paracentral zones of spherical cataract lenses, with the same measurements repeated through conoid cataract lenses of the same prescription, on five aphakic eyes with normal acuity.

The degree to which acuity falls through the periphery of a spherical cataract lens as a result of the chromatic and nonchromatic blurring aberrations, is modified by the size of the pupil of the eye; the larger the pupil, the more rapidly will acuity fall as the eye proceeds across the lens. With the conoid cataract lens the fall in acuity through the periphery of the lens is the result of two factors. One of these is chromatic aberration. When lateral overcorrection and marginal astigmatism are eliminated, chromatic aberration will still be present to cause a slight reduction in acuity. The other is ocular astigmatism. The use of a toric surface on the eye side of the lens to correct ocular astigmatism results in a departure from the ideal inner spherical surface for which the lens was designed. The extent to which acuity will fall when there is ocular astigmatism is in proportion to the amount of ocular astigmatism which is corrected and to the size and shape of the pupil.

Reading range (depth of focus)

One of the remarkable aspects of the conoid cataract bifocal lens is the large range of distances over which reading vision is possible in patients with normal acuity. For example, one bilateral aphakic patient using a +2.75D. reading addition was able to read fine print at distances between eight to 18 inches from the spectacle plane. This "depth of focus" effect simulates accommodation and for this patient is equivalent to approximately 2.75D. of accommodation. In almost all of the patients with good acuity this effect was apparent, with a "depth of focus" varying from two to three diopters. The explanation for this effect is that the correction for marginal astigmatism extends across the reading segment area, making reading vision extremely clear. Only when the reading material is considerably removed from the object plane is the retinal image sufficiently blurred to impair the reading of the fine print.

Distortion

Distortion was not quantitatively measured, but was demonstrated by having the patient compare vision of a broad expanse of buildings through the spherical and the conoid cataract lenses. The patients were readily able to perceive the lack of distortion through the conoid as compared to the spherical cataract lens.

In addition to the clinical demonstration of increased peripheral acuity, increased reading range, and decreased distortion, each patient was asked to fill out a questionnaire containing the following questions:

How long have you had the conoid cataract lenses?
Did you have another type of cataract glasses previously?
Are the conoid cataract lenses an improvement over the other type?
Has there been an improvement in straight-ahead vision?
Has there been an improvement in side vision?
Is there less distortion?
Has there been any improvement in your ability to judge the position of things?
Have you noticed an increase in the field of vision?
Has it helped you in walking?
Has it helped your driving?
Are the new lenses better for reading?
Has it increased the range of distances over which you are able to read?
Have the new glasses been helpful to you in your work?
Are you a student?
Has the new lens been helpful to you in your studies?
Comments:

Out of a total of 68 questionnaires, 53 were returned, and of these, 52 responses were quite favorable. Included in the responses were phrases such as "wider field, improved reading, better vision through the edges of the lens, easier walking, easier driving, better judgment of the position of objects, able to distinguish people from the side, easier backing up a car, everything is straight up and down with them, can see both sides of the face when shaving, no distortion with them, easier to get around with them."

Seldom does one have the opportunity of having as meticulous an observer as Dr. Alan C. Woods to evaluate a lens. Dr. Woods has kindly allowed me to publish excerpts from his letters to me regarding his observations on the conoid cataract bifocal:

> I put them on at once and have worn them now for the last 24 hours with a great deal of comfort. I have endeavored to compare them with . . . other lenses. I find that with either a 35-mm. or a 40-mm. spherical lens, I have an area of undistorted vision of about 12 mm. With the conoid lenses I have an area of central clear, undistorted vision of about 26 mm. Beyond this, with my error, I begin to get distortion. However, these give a one hundred percent larger central field than I have with the ordinary glasses. This is a tremendous improvement!
>
> The glasses gave me the same central vision that I had before (20/15+ in one eye and 20/15— in the other).
>
> Interestingly enough, I have a large degree of exophoria for near, and for long reading wear a pair of special glasses which contain 3° prisms, bases-in, in the ground-in bifocal addition. However with your glasses without the prisms I read last evening for about three hours with no discomfort at all.
>
> I shall be interested to know the experience of other aphakics with them. I am more comfortable with them than with any other I have had as yet. I notice the same depth of vision of which you speak in your letter. This is probably the reason I am able to use them at a greater dirtance without the prisms base-in.

Fitting of cataract spectacles

Regardless of the type of cataract lens which is used as the prescription lens, there are certain examination procedures and certain grinding and fitting procedures which insure the best result.

For the examination procedure, the interpupillary distance should be accurately determined and the trial frame set for this distance. The trial frame should be leveled with respect to the two eyes and adjusted so that the eyes will be looking approximately through the center of the lens cell. In addition the trial frame may be angled with respect to the face. The above may be summarized by stating that the trial frame should be placed on the face in such a way that the lenses will be in the same effective position as is expected for the final spectacles.

During the refraction it is best to place the strong plus spherical trial lens in the posterior cell of the trial lens at a sufficient distance from the eye to just clear the lashes. Generally a nine to 10 mm. distance from the cornea will suffice. This technique makes it unnecessary to measure the vertex distance from the cornea since the spectacle, if placed at the same distance, will have the same prescription as the trial lens. Therefore, no modification of the spectacle prescription will be necessary as in the case when there is a differnce in vertex distance between the trial lens and the spectacle lens.

The ideal fitting of a spectacle lens demands that the optic axis of the lens coincide with the line of sight of the eye and that the lens be placed as close to the eye as possible. As the distance between the lens and eye increases, all aberrations are increased. In addition, the field of view is diminished. Any parallel displacement of the optic axis of the lens from the line of sight of the eye induces both power change and astigmatism. Tilting of the optic axis of the lens with respect to the line of sight of the eye also induces power change and astigmatism. Thus the position of the spectacle lens should be as close to the eye as possible and decentered as little as possible. Since the line of sight of the eye is most often directed below the horizon, the lens should be angled such that its lower edge is relatively close to the face.

The spectacle frame should have simple-shaped lenses. It is the maximum diameter of a spectacle lens which limits the minimum thickness. Hence it is best to use small lenses and lens shapes in which the maximum and minimum diameters are not too different.

By using simple lens shapes, thickness can be considerably reduced. While minimum thickness is obtained with round and

leaf-shaped lenses, such shapes are not often desired by patients, nor are they necessary. It has been my experience that the following lens shapes result in nice looking and relatively thin lenses: for men, the Ronsir and the Commentator shapes; for women, the Starmont, the Clic, and the Leading Lady shapes. In all of the named shapes, the grinding of two to three prism diopters of prism base-up, bilaterally, results in thinner lenses. Improved appearance can be obtained by beveling the lenses primarily on the eye side and using a small amount of bevel on the front, the "French bevel." Such a bevel makes possible the resurfacing of a lens either for purposes of prescription modification or for reduction of thickness should the lens have inadvertently been surfaced too thick. In either case removal of glass from the back surface of the lens will not result in a decrease in the diameter of the lens.

Any thin lens or lens with a thin edge is subject to the strain due to frame pressure. If the lens is held by a wire frame, the thin edges may beome strained, with the danger of cracking should the frame be unduly twisted. This danger can be greatly reduced by polishing the bevel, especially at the thin edges.

There is some choice in the over-all lens size which may be used. For example, in a patient with a 66-mm. interpupillary distance, it is possible to obtain spectacles with either 46-mm. lenses and a 20-mm. bridge, or 44-mm. lenses and 22-mm. bridge. In both cases the lenses will be properly centered but in the second case the result will be thinner and lighter lenses. In general, it is best to keep the lens size down and increase the distance between the lenses whenever sufficient lens size remains and where there are no unusual facial features to require the larger lens.

Summary

A series of glass conoid cataract lenses using ellipsoids of revolution as the front surface has been designed to correct the severe blurring and distortion which aphakic patients experience through the periphery of spherical cataract lenses. The conoid cataract lenses have a gradually reducing power from the center to the edge and present to the eye of the wearer the same effective prescription for all directions of gaze. Single vision and bifocal lenses are made; the bifocal segment is "buried" so that the correction of aberrations by the front conoid surface includes the reading area.

Clinical evaluation of vision through conoid cataract lenses (as compared to that through spherical lenses) indicates marked improvement of vision through the periphery of the lenses, negligible distortion, and a large "depth of focus" through the reading area. Responses by patients to a questionnaire on the lenses are quite favorable, the patients commenting on improved vision for a wide variety of visual tasks.

A careful refraction should include the adjustment of the trial frame to a position which is close to the expected setting of the final spectacles. By placing the strong plus lens in the rear cell during the refraction, the likelihood is greatest that the vertex distance and power of the trial lens and that of the spectacle lens will agree.

The appearance, performance, and weight of cataract lenses will be best if lens shapes are kept simple, and if the eye size of the lens is kept small. Additional decrease in thickness and weight can be achieved by grinding two to three prism diopters of base-up prism. Lens size and bridge size should be so selected that decentering of the lens is avoided, since decentering results in a thicker lens.

In contrast to spherical cataract lenses, conoid cataract lenses do not cause a distorted appearance of the wearer's eye, since magnification of the eye by the lens is practically uniform.

2460 Fairmount Boulevard (6).

EXPERIMENTAL TRABECULECTOMY IN GLAUCOMA*

H. Saul Sugar, M.D.
Detroit, Michigan

Our present information regarding the physiology of aqueous circulation indicates that trabeculectomy should be an effective method of lowering intraocular pressure in glaucoma. Barkan's goniotomy procedure appears to have been effective in congenital glaucoma from the mass of reported successful cases. However, in simple glaucoma in adults such success has not resulted.

Grant[1] did experimental trabeculectomies in enucleated human eyes and found a significant increase in facility of outflow tonographically. Similarly, Dellaporta[2] performed anterior trabeculodialysis by which the trabeculae were detached from their natural bed in 95 percent of 58 enucleated eyes.

Redmond Smith[3] has described a method of opening the canal of Schlemm and trabecular meshwork with a nylon suture passed into the canal in one third of the globe. The suture was then pulled taut so that it burst through the wall of the canal and through the trabeculae into the anterior chamber. The operation was done on cadaver eyes and on a living subject just before enucleation.

Because of the interest in this theoretically important experimental procedure of trabeculectomy, clinical experience should be of some value, although it has been unsuccessful in relieving glaucoma. I am, therefore, presenting this experience in nine cases in which trabeculectomy was performed. These include seven cases of trabecular curettage and two cases in which a small segment of trabecular meshwork and presumably Schlemm's canal was removed. One of the latter cases was in a normal cataractous eye in which the procedure was done as a trial prior to its use in a glaucomatous eye.

The first six cases of trabecular curettage were done on patients with capsular glaucoma and were mentioned in a paper on gonioscopy.[4] In all instances the tension remained normal for a period ranging from three days to four months but returned to its previous level in every case. In two, the tension remained normal for two and four months, respectively. In the case in which the tension had remained below 18 mm. Hg (Schiøtz, 1924) for four months, the curettage, done with a Barkan knife used as a curette, had removed a portion of the trabecular meshwork and scleral spur in one area. I felt that an internal small cyclodialysis had been temporarily effective.

Case reports

Case 1

J. P. (fig. 1), a 41-year-old Iranian man, was first seen on May 1, 1939. He had noticed decreasing left vision for the past three months. The right eye was known to be amblyopic since early childhood. There was no history of squint; no history of halos, headache or pain could be elicited. The visual acuity was 20/70 R.E., and 20/25 L.E., corrected. The tension was 28 mm. Hg (Schiøtz) R.E., and 52 mm. Hg, L.E. The visual fields were normal except for a Seidel scotoma on the left. Both pupils reacted normally to light. Slitlamp examination revealed a normal capsule in the right eye and marked capsular exfoliation on the left. The angles were open, the left showing a typical trabecular pigment ring. The ocular fundi were normal. Instillations of two-percent pilocarpine nitrate were ordered four times daily in the left eye. The tension did not fall below 48 mm. Hg, L.E., although the pupil constricted well. Eserine was used preoperatively without effect. On May 5, 1939, a trabecular curettement was performed on the left eye. The bandage was removed on the following day. No medications were used. The tension in the left eye remained normal for the following three weeks. The patient was then not seen for three months at which time his tension was again above 50 mm. Hg.

Case 2

T. F. (fig. 2), a 74-year-old man, was first seen in May, 1939. He complained of gradually decreasing vision for the past three years. He gave no history of halos, headaches or pain. The visual acuity was 5/200, R.E., and light perception and projection, L.E. The tension was 35 mm. Hg (Schiøtz), R.E. and 48 mm. Hg (Schiøtz), L.E. Pilocarpine (two percent) was ordered for both eyes as instillations four times daily. Typical capsular exfoliation was

* From the Sinai Hospital of Detroit and Wayne State University College of Medicine.

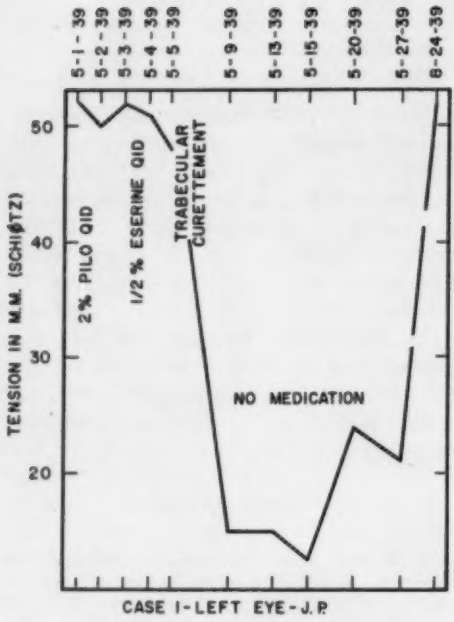

Fig. 1 (Sugar). Tonometric record in Case 1.

present in both eyes. Because the miotics were ineffective, a left trabecular curettage was performed on June 26, 1939, without a contact lens. The knife injured the superficial layers of the iris before touching the trabeculae. A moderate iritic reaction followed. No medications were used. On gonioscopic examination a very small area of the trabecular meshwork had been curetted. The tension remained up for a week and then decreased to normal where it remained until July 26, 1939, when a lens extraction was performed.

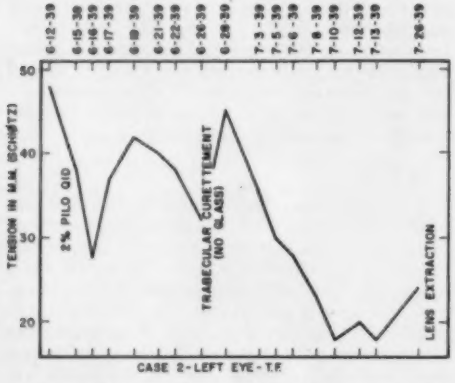

Fig. 2 (Sugar). Tonometric record in Case 2.

Case 3

W. A. (fig. 3), a 74-year-old man, was first seen on May 26, 1939. An Elliot trephining operation had been performed on the left eye in Seattle in 1935. Vision in the right eye had been failing for the past six months. The visual acuity was 10/200, R.E., corrected and light perception, L.E. The tension was 50 mm. Hg (Schiøtz), R.E., and 15 mm. Hg, L.E. The visual field, R.E., showed complete loss of most of the nasal field, involving the macula. Bilateral capsular exfoliation and nuclear sclerosis were present. A trabecular pigment ring was present in each eye. Pilocarpine (two percent) was ordered four times daily in the right eye. The tension remained above 30 mm. Hg most of the time. On June 30, 1939, a trabecular curettement was performed on the right eye using the Barkan equipment. The tension remained normal for four months and then returned to its previous levels.

Case 4

M. M., an 80-year-old woman, was first seen on August 21, 1939. She had a history of poor left vision for one year. The visual acuity was 20/40 each eye, corrected. Typical capsular exfoliation was present in each eye. The visual field, R.E., was normal; that of the left showed enlargement of the blindspot. The tension was 30 mm. Hg, each eye. Tension of the left eye stayed at 30 mm. Hg on miotics. On August 31st a left trabecular curettage was done. The tension was normal for 11 days and then was elevated to 32 mm. Hg and varied between 21 and 37 mm. Hg thereafter. On pilocarpine it was reduced to the upper limits of normal.

Case 5

J. L., a 65-year-old man, was first seen on September 11, 1939, with a three-week history of pain in his left eye. The visual acuity was normal, R.E., and reduced to 20/200, L.E. The tension was 21 mm. Hg, R.E., and 60 mm. Hg, L.E. Typical capsular exfoliation was present in the left eye only. The left angle was entirely open and contained a trabecular pigment ring. Tension in the left eye re-

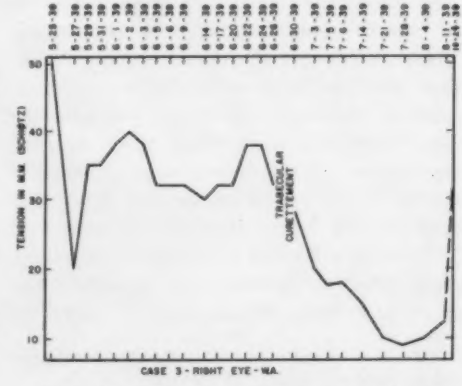

Fig. 3 (Sugar). Tonometric record in Case 3.

mained between 30 and 52 mm. Hg on miotics. On September 15th a trabecular curettage was done on this eye. On September 19th the tension was elevated to 41 mm. Hg and remained between 35 and 48 mm. Hg. On September 28, 1939, a second trabecular curettage was done on the left eye. The tension remained low for three days and was 30 mm. Hg on October 1st. It was 52 mm. Hg on October 3rd and was not controlled with miotics. A successful trephining operation was done on October 5, 1939.

CASE 6

C. McG., a 73-year-old woman, was first seen in June, 1939, because of poor vision in her right eye. Visual acuity, R.E., was 20/70 corrected. The left eye had been blind for some time. The visual field, R.E., was limited to 30 degrees in all directions. Tension was 32 mm. Hg, R.E., and 53 mm. Hg., L.E. Capsular exfoliation was present in each eye. A trabecular curettage on the right eye was successful for two months after which the tension returned to its previous level and was treated continually with miotics.

In 1956, after attending the first Macy Foundation Conference, I felt that further attempts at trabeculectomy might be worthwhile. A curettage of the trabecular meshwork in a patient with pigmentary glaucoma was done but was unsuccessful.

CASE 7

R. O., a 30-year-old man, was seen in December, 1956, because of decreasing vision in the right eye for one and one-half to two years. At times he had noticed haziness and colored halos about lights at night. The visual acuity was 20/20 each eye, corrected with a —0.5D. sph. ⊂ +0.25D. cyl. ax. 180°, R.E., and no correction, L.E. The right disc was excavated, the left was normal. Krukenberg spindles and trabecular pigment rings typical of pigmentary glaucoma were present. The tension was 38 mm. Hg, R.E., and 28 mm. Hg, L.E. (1954 Schiøtz scale). On homatropine the tension after one hour was 36 mm. Hg, R.E., and 31 mm. Hg, L.E. Tonography indicated a coefficient of outflow of 0.14, R.E. The visual field, R.E., for 3/330 showed nasal constriction to 30 degrees. The possibility of trabecular curettement was discussed with the patient and was performed on the right eye on January 9, 1957. The tension remained between 15 and 20 mm. Hg, R.E., and between 17 and 19 mm. Hg, L.E., until February 2, 1957, when the tension was 35 mm, Hg, R.E., and 24 mm. Hg, L.E. Pilocarpine (two percent) was used without avail and an iridencleisis, R.E., was successfully carried out on February 20, 1957.

Following this experience it occurred to me that the curettage opening in the trabeculae tends to be self-closing and that some other procedure was therefore indicated.[5] Experiments on eye-bank eyes resulted in a technique whereby a conjunctival flap was drawn down from above as for cataract extraction. Then a scleral flap was made, beginning about three mm. from the corneolimbal junction, involving half the scleral thickness. This incision was carried down to one mm. anterior to the sclerolimbal junction. A keratome incision was then made into the anterior chamber at the sclerolimbal margin and the limbal incision extended exactly as in cataract extraction to include the upper two fifths of the limbus. A Herbert punch forceps blade was introduced through the 12-o'clock position of the incision, directed toward and up to the angle recess. A two mm. section of the trabeculae and Schlemm's canal was removed with the punch forceps. A peripheral iridectomy was made and then the limboscleral wound was sutured with five silk sutures after which the conjunctiva was closed with catgut sutures (fig. 4).

This operation was performed in a living eye as a preliminary to a cataract extraction. Subsequent gonioscopy showed the operation to be successful in removing a section of the trabeculae. As a result of its use it was felt that it could be used in a patient with pigmentary glaucoma. The operation was technically uneventful but it was unsuccessful in normalizing the tension for over two weeks. Gonioscopy showed a successful trabeculectomy. It was felt that the punch forceps probably closed the ends of Schlemm's canal and the trabeculae by crushing.

H. T., a 46-year-old woman, was first seen on November 4, 1954. Her visual acuity was 20/20, R.E., and 20/25, L.E., corrected with a —4.0D. sph. ⊂ +1.25D. cyl. ax. 103°, R.E., and a —4.0D. sph. ⊂ +1.0D. cyl. ax. 82°, L.E. The tension was 32 mm. Hg (Schiøtz), R.E., and 56 mm. Hg, L.E. Krukenberg spindles and the typical trabecular pigment rings of pigmentary glaucoma were present. After one drop of pilocarpine (two percent) the tension fell to 25 mm. Hg, R.E., and 28 mm. Hg, L.E. The visual field, R.E., was normal, the left was constricted 15 degrees concentrically. The tension remained between 20 and 27 mm. Hg, R.E. (1954

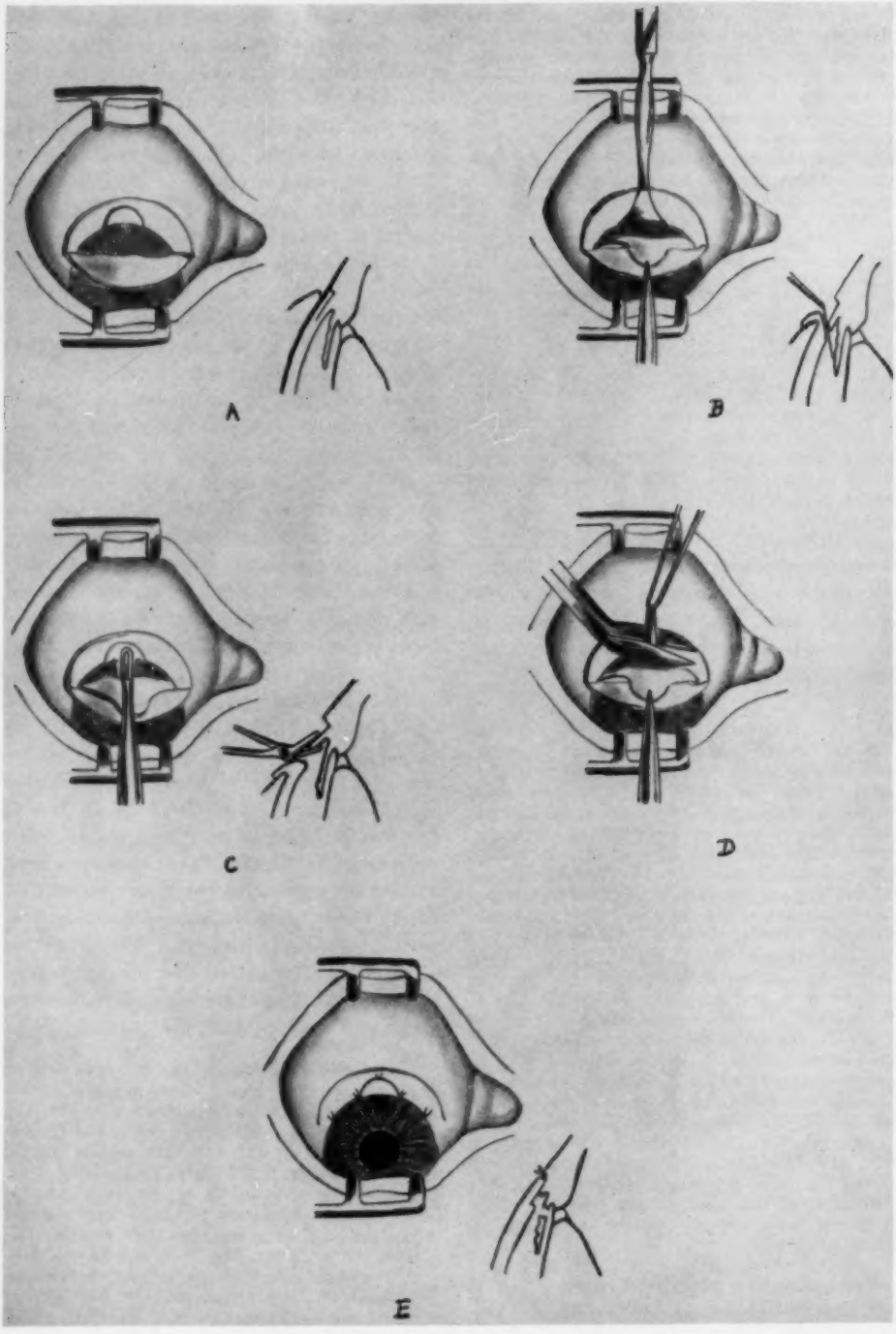
A
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Fig. 4 (Sugar). *Operative procedure.* (A) A conjunctival flap is drawn down and a scleral flap prepared, involving half the scleral thickness and extending from three mm. from the corneolimbal margin to one mm. anterior to the sclerolimbal margin. (B) A keratome incision is made at the sclerolimbal margin into the anterior chamber and the limbal incision extended exactly as in cataract extraction to include the upper two fifths of the limbus. (C) A Herbert punch forceps blade is inserted and directed toward the angle recess. A two mm. section of trabecular wall is removed. (D) A peripheral iridectomy is made. (E) Sutured incisions in limbosclera and conjunctiva.

scale) and between 21 and 31 mm. Hg, L.E., on miotics. On February 14, 1956, surgery was advised and the possibility of a trabeculectomy discussed with the patient. This was done but the tension remained normal for only about two weeks. On March 23, 1956, the tension, L.E., was 60 mm. Hg. An Elliot trephination was successfully done on March 28, 1956.

Summary

Nine clinical instances of trabeculectomy are recorded. Eight were done in eyes with glaucoma capsulare or pigmentary glaucoma. Failure was probably due to the tendency to healing in wounds of the trabeculae and to closure of the edges of Schlemm's canal by the crushing action of the punch forceps in the instances in which they were used. Further experimental methods, such as those of Redmond Smith or Dellaporta, are to be encouraged.

18140 San Juan (21).

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THE VALUE OF THE MIDDLEBROOK-DUBOS HEMAGGLUTINATION TEST FOR TUBERCULOSIS*

When run on aqueous samples of eyes with granulomatous iridocyclitis

T. F. Schlaegel, Jr., M.D., J. L. Arbogast, M.D., and L. A. Estela, A.B.
(With the technical assistance of K. Kimura, M.D., E. Dritasas, M.T., and D. Godwin, A.B.)
Indianapolis, Indiana

Since a large percentage of adults have had systemic tuberculosis, aqueous titers for tuberculosis should be of little significance unless the presence of an iridocyclitis due to tuberculosis exerts some specific effect on the antibody level of the aqueous humor. If a tuberculous iridocyclitis has no such specific effect, testing aqueous humor with the Middlebrook-Dubos method can be no more than

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a rather dangerous and indirect method of determining the blood serum titer value.

Animal studies

Since the potential practical value of the Middlebrook-Dubos test on aqueous humor lies in its possible ability to differentiate tuberculous from nontuberculous iridocyclitis, these two types of uveitis were produced in the same rabbits; and since tuberculous uveitis in man is not a primary affection but is secondary to systemic tuberculosis, these rabbits were first given systemic tuberculosis.

Method of procedure

Twenty-one adult mongrel rabbits, weighing more than 3.0 but less than 5.0 kg., and having normal eyes, were injected subcutaneously in the groin with 0.25 ml. of a thick salt solution of the H37RV strain of human tubercle baccilli (10^9 living bacilli). During the experiment seven rabbits died, four early in the study and three later on. After four weeks the anterior chambers of the rabbits were injected with either H37RV tubercle baccilli or with horse serum. Horse serum was used as a control agent to produce a nonspecific granulomatous iridocyclitis. One eye of each rabbit received tubercle bacilli and one eye horse serum, but the selection of which anterior chamber received which type of inoculum was done in a random fashion and the ophthalmologist doing the grading (K. K.) kept in ignorance. The anterior chamber injections were made with 30-gauge needles on tuberculin syringes. One eye received 0.2 ml. of 0.018 mg. packed wet weight of tubercle bacilli and the other eye 0.015 ml. of normal horse serum that had been sterilized through a Seitz filter. The rabbit eyes were graded clinically with the aid of a slitlamp microscope.

The Middlebrook-Dubos test was run on the blood serum at weekly intervals for the four weeks before and the four weeks after the injection into the eyes (fig. 1). Since in the practice of ophthalmology it is desirable to test the first aqueous obtained on keratocentesis and not have to repeat the test for a more protein-rich secondary aqueous, and since the primary aqueous might be expected to be less influenced by the antibody titer of the blood and more influenced by the possible local production of antibodies, only primary aqueous was studied in this experiment. It was collected before the intraocular injections and weekly thereafter for four weeks (fig. 1). The aqueous samples were coded so that the medical technologist running the test was not cognizant of their source. The technique was that previously reported except that it was considered unnecessary to inactivate the complement in the aqueous.

Results of animal experiments

In Figure 1 it can be seen that the mean titer in the blood serum was slightly elevated before the attempt to make our rabbits tuberculous by injecting them in the groin with tubercle bacilli. It is possible that these rabbits contracted tuberculosis by aerosols from infected guinea pigs in the same room. As far as this experiment is concerned it is not important since we wished to produce systemic tuberculosis before the injection into the eyes. A group of eight more isolated control rabbits injected intraperitone-

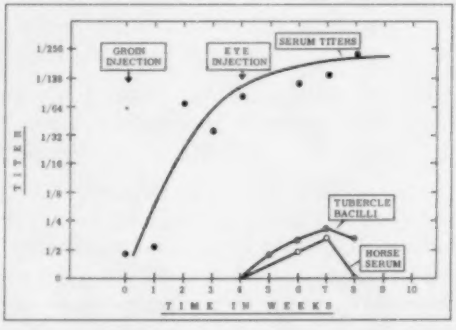

Fig. 1 (Schlaegel, Arbogast and Estela). Serum and aqueous Middlebrook-Dubos titers before and after groin injection of tubercle bacilli at 0 weeks and anterior chamber injections of either horse serum or tubercle bacilli at four weeks.

ally with 0.05 ml. of horse serum and three injected with the Tween-80 preparation had uniformly negative serum and aqueous humor titers on the Middlebrook-Dubos test.

It is logical to assume that if the aqueous titers for tuberculosis are simply a result of leakage or transudate from the blood into the aqueous humor, the aqueous humor titers would correlate only the severity of the iridocyclitis produced. At one week after the intraocular injections (fig. 2) there was no correlation of the aqueous titers with either the severity of the iridocyclitis or with the fact that one eye of each rabbit was injected with tubercle bacillii and the other with horse serums. After this first week, however, the height of the aqueous titers was definitely correlated, not with the severity of the iridocyclitis, but with the injection of tubercle bacilli into the eye (figs. 3, 4, and 5). After the first week there was no instance in which a rabbit with systemic tuberculosis gave an aqueous titer of greater than ¼ in the eye injected with horse serum. It would thus be apparent that a titer of ⅛ or above would diagnose the presence of tuberculous iridocyclitis in this experimental group of rabbits without resulting in any false positives. On the other hand false negatives are apparent in that many of the eyes receiving tubercle bacilli had titers below ⅛. Inspection of

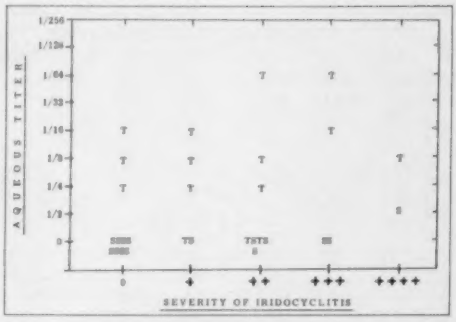

Fig. 3 (Schlaegel, Arbogast and Estela). Correlation of severity of iridocyclitis (0-4+) with aqueous titer (0-1/256) in each of the eyes of 15 tuberculous rabbits two weeks after the intraocular injection of either tubercle bacilli (T) or horse serum (S).

the data reveals that the more logical cut-off point is the dividing line between 0 and ½. Even this low dividing line will result in some of our cases of experimental tuberculous iridocyclitis being missed since at two, three, and four weeks there are some eyes injected with tubercle bacilli with a negative aqueous titer (figs. 3, 4, and 5).

Clinical studies

Our uveitis patients routinely had their serums tested and whenever possible those patients with iridocyclitis also had both their

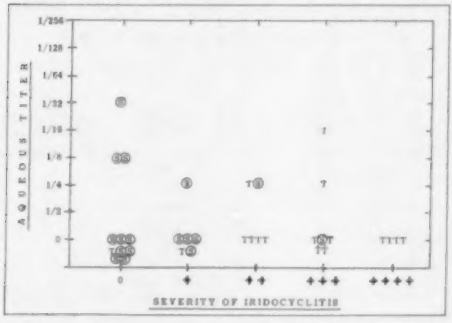

Fig. 2 (Schlaegel, Arbogast and Estela). Correlation of severity of iridocyclitis (0-4+) with aqueous titer (0-1/256) in each of the eyes of 17 tuberculous rabbits one week after the intraocular injection of either tubercle bacilli (T) or horse serum (S).

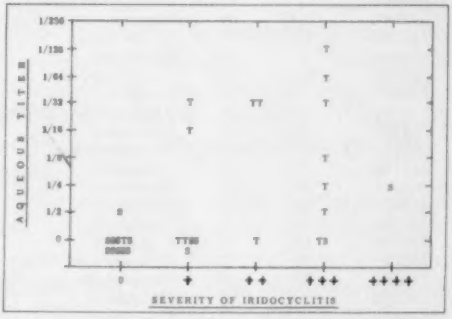

Fig. 4 (Schlaegel, Arbogast and Estela). Correlation of severity of iridocyclitis (0-4+) with aqueous titer (0-1/256) in each of the eyes of 15 tuberculous rabbits three weeks after the intraocular injection of either tubercle bacilli (T) or horse serum (S).

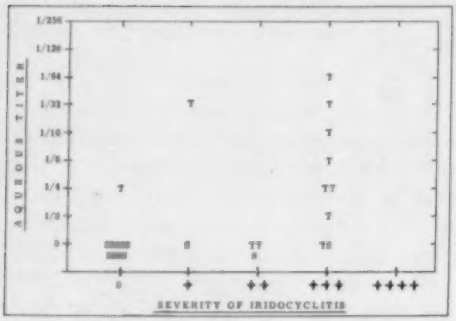

Fig. 5 (Schlaegel, Arbogast and Estela). Correlation of severity of iridocyclitis (0-4+) with aqueous titer (0-1/256) in each of the eyes of 12 tuberculous rabbits four weeks after the intraocular injection of either tubercle bacilli (T) or horse serum (S).

aqueouses checked by the Middlebrook-Dubos method. Those cases of iridocyclitis which had the aqueous tested included both the pure variety and the type which is apparently a spill-over from or reaction to an inflammation in the posterior segment. There were 34 patients who had both their aqueous and serum tested by the Middlebrook-Dubos technique (table 1). Sixty-five percent of these 34 patients had a positive serum titer whereas only 26 percent had a positive aqueous titer. The serum titers tended to run higher than the corresponding aqueous values.

In Table 2 we have compared the titer values from the serum of all our uveitis patients grouped by diagnosis into those with tuberculous and those with nontuberculous

TABLE 1

DATA ON 34 PATIENTS WITH IRIDOCYCLITIS WHO HAD BOTH SERUM AND AQUEOUS DETERMINATIONS ON THE MIDDLEBROOK-DUBOS TEST

Hospital Number	Gran. or Non-gran.	Anterior or Both Segments	Diagnosis	Serum Titer	Aqueous Titer	Tuberculin Reaction	Isoniazid Therapeutic Test
257578	G	A	Unknown	1–8	0	0	0
261444	G	A	Heterochromic cyclitis	1–2	0	PPD #2	0
262716	G	A	Unknown	0	0	0	0
261984	G	B	Tuberculosis	1–32	0	0	0
24816	G	B	Toxoplasmosis	0	0	f PPD #1	0
264210	G	B	Toxoplasmosis	0	0	0	0
236198	G	B	Unknown	0	1–2	1/1,000	0
256788	G	A	Unknown	1–32	0	0	Equivocal
204716	G	A	Unknown	1–32	0	0	Not done
246779	G	A	Virus infection	1–64	0	0	Not done
259460	G	B	Toxoplasmosis	1–32	1–4	Not done	Not done
260444	NG	A	Rheumatoid arthritis	1–64	1–4	PPD #2	Not done
248356	G	B	Tuberculosis	1–32	1–16	0.1 of 1/100	Positive
249962	G	B	Unknown	0	0	1/1,000	0
251736	G	B	Toxoplasmosis	0	0	0	0
250973	G	A	Unknown	0	0	0	0
214942	NG	A	Rheumatoid arthritis	0	0	0.1 of 1/100	0
254399	NG	A	Unknown	0	0	0.1 of 1/100	Not done
103769	G	A	Toxoplasmosis	0	0	Not done	Positive
245126	NG	A	Unknown	0	0	1/10,000	0
205444	NG	A	Unknown	0	0	1/10,000	0
249971	G	A	Unknown	1–8	0	1/1,000	0
256266	NG	B	Unknown	1–8	0	0.1 of 1/100	Not done
250998	G	A	Unknown	1–8	0	1/1,000	0
256775	G	B	Unknown	1–8	0	0.1 of 1/100	0
256791	G	A	Heterochromic cyclitis	1–8	0	1/10,000,000	0
256750	NG	A	Unknown	1–8	0	1/10,000,000	Not done
236812	G	B	Unknown	1–8	1–2	0	0
171827	G	B	Unknown	1–4	1–4	1/1,000	0
239139	G	A	Tuberculosis	1–8	1–16	1/10,000	Positive
139715	G	B	Toxoplasmosis	1–16	0	1/1,000	0
249999	G	B	Toxoplasmosis	1–16	0	0.1 of 1/100	0
248399	G	A	Tuberculosis	1–16	1–4	1/100,000	Positive
246795	G	B	Toxoplasmosis	1–16	1–16	0.1 of 1/100	0

TABLE 2

THE MIDDLEBROOK-DUBOS SERUM TITERS COMPARING TUBERCULOSIS WITH NONTUBERCULOSIS GRANULOMATOUS UVEITIS CASES

	0	1/2	1/4	1/8	1/16	1/32	1/64	1/128	1/256	Total
Tuberculous	3		1	3	4	1	1			13
Nontuberculous	11	5	1	10	11	6	4		1	49

TABLE 3

THE MIDDLEBROOK-DUBOS AQUEOUS TITERS COMPARING TUBERCULOUS WITH NONTUBERCULOUS GRANULOMATOUS UVEITIS CASES

	0	1/2	1/4	1/8	1/16	1/32	Total
Tuberculous	1		1		2		4
Nontuberculous	15		2		1		18

TABLE 4

A COMPARISON OF MIDDLEBROOK-DUBOS SERUM VALUES IN GRANULOMATOUS AND NONGRANULOMATOUS UVEITIS CASES

	0	1/2	1/4	1/8	1/16	1/32	1/64	1/128	1/256	Total
Granulomatous	29	5	9	16	23	13	7	1	1	104
Nongranulomatous	11	2		9	4	4	7			34

TABLE 5

A COMPARISON OF MIDDLEBROOK-DUBOS AQUEOUS VALUES IN GRANULOMATOUS AND NONGRANULOMATOUS UVEITIS CASES

	0	1/2	1/4	1/8	1/16	1/32	1/64	1/128	1/256	Total
Granulomatous	23	2	4		3					32
Nongranulomatous	6		1							7

uveitis. The diagnosis of tuberculous and nontuberculous uveitis was based on a thorough uveitis survey including skin tests, X-ray studies, blood tests, and the isoniazid-streptomycin therapeutic test for tuberculosis. Only those cases that were given a diagnosis other than tuberculosis and none of the undiagnosed cases were included in the group labeled as nontuberculous. All decisions as to etiology were made before the values of the Middlebrook-Dubos titer were known. Assuming that our clinical diagnosis of tuberculosis has some validity, it is apparent that the Middlebrook-Dubos test on blood serum is not of help since 10 of 13 or 77 percent of those diagnosed as tuberculous had positive titers as compared to 38 of 49 or 78 percent of those considered not tuberculous. When we turn to the aqueous values (table 3) on the Middlebrook-Dubos test, however, we find that three of four or 75 percent of those considered to be tuberculous had positive titers as compared to three of 18 or 15 percent of those considered not tuberculous.

Further evidence for the lack of value of the serum determination of the Middlebrook-Dubos and the possible value of the aqueous titer in the diagnosis of tuberculous uveitis is apparent from a study of Tables 4 and 5 where the titer values of granulomatous and nongranulomatous cases of uveitis are compared. We tested 104 patients with granulomatous uveitis and found 75 or 72

TABLE 6

A COMPARISON OF THE MIDDLEBROOK-DUBOS SERUM TITERS IN UVEITIS CASES WITH A POSITIVE AS COMPARED TO A NEGATIVE RESPONSE TO ISONIAZID

	0	1/2	1/4	1/8	1/16	1/32	1/64	1/128	1/256	Total
Positive Therapeutic Test	5		1	3	3	1				13
Negative Therapeutic Test	20	4	4	12	12	8	4			64

percent to be positive as compared to 68 percent or 23 of 34 nongranulomatous cases. It is obvious that there is no significant difference between these two samples. When we turn to the aqueous titers (table 5) we find twice the percentage in the granulomatous as compared to the nongranulomatous group. Nine of 32 or 28 percent of the aqueous titers were positive in the granulomatous cases as compared to one of seven or 14 percent in the nongranulomatous.

The isoniazid-streptomycin therapeutic test for tuberculosis may prove to be one of our best measures for the diagnosis of tuberculous uveitis. In Tables 6 and 7 we have compared the titer values obtained in uveitis cases with positive as compared with those with a negative response to either isoniazid and streptomycin or isoniazid alone. The serum titers were positive in eight of 13 or 62 percent of those with a positive response and 44 of 64 or 69 percent of those with a negative response to isoniazid. Contrast these insignificant findings with those in Table 7 where we see that the aqueous humor was positive in four of five or 80 percent of those having a positive isoniazid response as compared to five of 26 or 19 percent of those having a negative test.

Thus the aqueous test appears to be of value in helping differentiate between those cases which are probably tuberculous and those which are probably not tuberculous whereas the serum Middlebrook-Dubos test is without any value in this regard.

DISCUSSION

Most investigators have considered a serum Middlebrook-Dubos titer of 1/8 as positive evidence of systemic tuberculosis with positive reactions in 75 to 90 percent of tuberculous patients as compared with nine to 26 percent in healthy adults. Some consider it a good indicator of the degree of activity of tuberculosis. When we turn to the eye, however, the value of serum values in the etiologic diagnosis of endogenous uveitis is far from convincing. For example Cremer and Cremer reported that 74 percent of patients with clinically ocular tuberculosis had a positive titer when the Middlebrook-Dubos test was run on their blood serum. They apparently did not run a control series. We found 77 percent of our patients diagnosed as having ocular tuberculosis had positive serum titers as compared to 78 percent of those diagnosed as not tuberculous. In this report we have also demonstrated that in our series of patients with iridocyclitis the serum values of the Middlebrook-Dubos test were unable to help differentiate between a granulomatous and a nongranulomatous etiology giving a positive response in 72 percent of the granulomatous as compared to 68 percent of the nongranulomatous cases. There was also no correlation of a

TABLE 7

A COMPARISON OF THE MIDDLEBROOK-DUBOS AQUEOUS TITERS IN UVEITIS CASES WITH A POSITIVE AS COMPARED TO A NEGATIVE RESPONSE TO ISONIAZID

	0	1/2	1/4	1/8	1/16	1/32	1/64	1/128	1/256	Total
Positive Therapeutic Tests	1		2		2					5
Negative Therapeutic Tests	21	2	2		1					26

positive response on the serum Middlebrook-Dubos test and the response of the patient to a therapeutic trial on isoniazid. The serum titers were positive in 62 percent of those with a positive response to isoniazid as compared to 72 percent of those with a negative response. Thus it seems fairly clear to us from our own experience and from a review of the literature that for the diagnosis of ocular tuberculosis the serum Middlebrook-Dubos test is without merit.

The value of the Middlebrook-Dubos hemagglutination test for tuberculosis when run on aqueous samples of eyes with granulomatous iridocyclitis seems much more promising despite the negative results of Lorenzen. Kiyosawa found the secondary but not the primary aqueous was positive for antibodies in immune allergic rabbits, but in animals given intraocular tuberculosis antibodies were found in the primary aqueous, as was our experience. Witmer observed that the antibody content of the gamma-globulin of the aqueous humor was higher in local infection than the antibody content of the serum; the local antibody activity in turn was roughly correlated with the degree of plasma cell infiltration of the uvea, and these plasma cells were found to contain the antibodies These studies of Witmer thus indicate that there is a specific reaction in the anterior chamber and the antibodies found there are not just a spill-over from the serum. Since our studies demonstrate a lack of correlation between serum and aqueous titers, they would tend to confirm Witmer's results.

Conclusions

1. Aqueous titers on the Middlebrook-Dubos hemagglutination test for tuberculosis do not correlate closely with the serum titers in the same animal or patient.

2. Serum Middlebrook-Dubos titers are of little or no value in the diagnosis of tuberculous iridocyclitis.

3. Aqueous Middlebrook-Dubos titers are of value in the diagnosis of tuberculous iridocyclitis but the following limitations must be remembered:

a. The aqueous titer may be zero in tuberculous iridocyclitis.

b. The aqueous titer may be positive without the patient having tuberculous iridocyclitis.

c. Our animal experiments would indicate that an aqueous titer of 1/8 is significant but our human studies do not clarify this problem.

4. Since the aqueous Middlebrook-Dubos test is of potential diagnostic value, it deserves further study.

1100 West Michigan Street (7).

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THE IMPORTANCE OF EARLY TREATMENT OF ESOTROPIA*

PER RIISE, M.D.
Hamar, Norway

During the last decades newer views on the pathogenesis of convergent squint have given rise to new principles of treatment (Duke-Elder's textbook) and one of the main points is that the treatment should start as early as possible.

From our ophthalmologic journals, however, we get the impression that these principles have been unsatisfactorily followed in ophthalmologic practice as we still see that the treatment of children with convergent squint starts when the child has reached school age. Consequently, the result is that only a small percentage obtained binocular vision and, as the binocular vision is the most important stabilizing factor for the position of the eye, there will often be a lability in the eyes' position after surgery at such a late stage.

Hoping to support the opinion that early treatment is preferable, I have collected data concerning my cases of convergent squint treated before the patients reached school age.

Uncertainty concerning etiology and pathogenesis will lead to uncertainty in therapy. Few things demonstrate this more clearly than the multitude of methods used during the past hundred years in the treatment of squint.

The uncertainty concerning the cause of squint has been a necessary consequence of the early stage of the child's development at which the ailment occurs, preventing the child from helping us with the information we need. When the child has become old enough to co-operate, so many changes have taken place in the binocular function that no one could distinguish cause from effect.

If the treatment of strabismus has been a weak point of ophthalmology, this has not been because of lack of interest but rather because of the confusing number of explanations given by various investigators.

Working from a simple theory about differences in muscular strength, Dieffenbach and Albrecht v. Graefe one hundred years ago began surgical treatment of strabismus. A relative of v. Graefe, Adolf Gräfe, maintained that the amblyopia in the squinting eye was congenital and unchangeable. This view was unfortunately accepted and has cast deep shadows on squint therapy for three fourths of a century. As recently as 1929 at the International Congress of Ophthalmology in Amsterdam, H. M. Morton

* From St. Torfinn's Eye Hospital.

maintained that the amblyopia was congenital and primary in relation to the squint.

This opinion has lead to a long period of passivity except toward those squinters who were included in Donders' hypermetropic and accommodative group and could be cured by glasses.

At about the turn of the century Javal and Worth put forward their doctrine of congenital lack of fusion. This doctrine opened the orthoptic era which flourished most in British eye clinics.

The mechanical view has had to relinquish pure muscular strength as the cause of strabismus because of the discovery that the eye muscles have many times the strength needed to move the eye. Instead, the many ligaments of the eye as well as the position and form of the orbit in children and adults were emphasized.

The school which seeks to set the entire treatment of squint on a new footing is, however, based on the fact that binocular vision is not an innate faculty but is dependent on reflexes which develop gradually during the first years of life. From this it follows that the smaller the child is, the less is the mechanical, motor, or innervational imbalance needed to bring about a squint.

The therapeutic consequence of this must be that early treatment, besides preventing amblyopia, also gives the best chances of establishing binocular function.

Material

My material consists of those children who from 1947 to 1955 have undergone muscle operations in treatment directed at achieving binocular function. With the exception of two patients, both aged six and one-quarter years, they have all at the commencement of treatment been under six years of age. I have established this age as the upper limit for which treatment along the lines I have adopted is reasonably rewarded by increased visual acuity and binocular function.

Consequently the material omits, with the exception of two, all those children who consulted me for the first time after their sixth year. Furthermore I have omitted patients with convergent squint under the age of six years who have not had surgical treatment for the following reasons:

1. Because binocular function has been achieved without operation (by means of occlusion, convex glasses, or prisms).

2. Cases from the years 1947-1950 because the method was still on an experimental stage. After 1951, only very few cases presenting congenital weakness of abduction or low intellect which did not seem to justify any long-lasting treatment.

3. Because of unwillingness or inability of parents to carry out the occlusion treatment.

Twelve of the children under six years of age treated by operation who should have been included in the material have been omitted because they disappeared from further treatment before results could be recorded.

The material consists, then, of 119 children, 52 boys and 67 girls.

The squinting eye was in 34 cases the right eye, in 65 cases the left, and 20 had alternating squint.

The angle of squint. Because of the early age of these children an exact measurement of the squinting angle was in many cases impossible on the first examination. The measurement or estimation of the angle gave the following results: 10-20 degrees in 40 cases; 25 to 30 degrees in 56 cases; more than 30 degrees in 18 cases; variable in one and not recorded in four cases.

Vertical component. In 14 cases the squinting eye was more or less lifted on adduction.

The refraction in each patient was examined under atropine mydriasis. One was slightly myopic, 16 were emmetropic, 40 had a hypermetropia between 0.5D. and 1.75D. and 63 had a hypermetropia of 2.0D. or more.

The age at which strabismus started. This will often be a matter of uncertainty as we

TABLE 1

ANALYSIS OF CASES STUDIED

No.	Name	Sex	Eye	Angle	Vertical component	Spherical refraction (atropine) R	L	Age, onset of squint (yr.)	Age, first therapy (yr.)	Correcting glasses	Preop. period with occlusion (mo.)	No. op.	Prism glasses	Last Observation: Age (yr.)	Total observation (yr.)	Observed since last op. (yr.)	Visual acuity R	Visual acuity L	Position, horizontal if necessary with glasses	Phoria, horizontal if necessary with glasses	Fusion	Depth perception	Total no. consultations
1	B. F.	F	L	30	+	E	E	Birth	1		14	3	−	13	12½	8½	6/6	6/9	P		+	+	33
2	B. H.	F	Alt.	30	+	+0.75	+0.75	3	3½		0	2	+	14½	10½	10½	6/6	6/6	P	4 eso	+	+	33
3	K. F.	F	L	25	−	+6.0	+6.0	½	1	+	0	2	−	10	9	7½	6/9	6/18	P	6 eso	+	+	14
4	E. H.	F	R	30	−	E	E	3½	4		0	1	−	13½	9½	9½	6/6−	6/6−	P	ortho	+	+	18
5	P. M.	F	R	45	−	+3.0	+3.0	4½	5	+	0	1	−	14	10	10	6/9	6/9	P	ortho	+	+	17
6	B. M.	F	L	30	−	+2.0	+2.0	2	4½	+	0	1	+	15½	10½	9½	6/6	6/9+	P	1 eso	+	+	13
7	A. R.	M	L	40	−	+3.5	+3.5	1	1½	+	0	1	+	10	9½	9½	6/6	6/12	P	2 eso	+	+	15
8	D. T.	F	L	15	−	+2.0	+2.0	2	2½	+	0	1	−	9	6	6½	6/9	6/36	P	1 exo	+	+	15
9	O. A.	M	R	25	−	+4.0	+4.0	1	3½	+	3	2	−	12½	9½	1½	6/9+	6/6+	5 exo	4 eso	+	+	10
10	K. J.	F	L	30	−	+3.5	+3.5	3½	4	+	0	2	+	10½	5½	4½	6/6−	6/6−	P	7 exo	+	−	35
11	K. L.	F	Alt	45	+	+3.0	+3.0	3	3½	+	0	3	+	13	10	8	6/6	6/6	P	10 eso	+	+	13
12	T. N.	F	R	25	−	+2.0	+2.0	2½	3½	−	0	2	−	14	8	8	6/6−	6/6−	P	2½ eso	+	+	17
13	K. R.	M	R	Variable	−	+1.0	+1.0	2	5	−	6	2	−	8½	4	3	6/6	6/6	P	5 eso ortho	+	+	16 11
14	A. B.	F	L	30	−	+6.0	+6.0	1½	2	+	2½	1	−	90	7	6½	6/6	6/6	P	0	+	+	14
15	O. H.	M	L	30	−	E	E	1	4	−	7	3	−	10	5½	2½	6/6	6/9	P	0	+	−	28
16	S. H.	F	L	25	−	+3.0	+3.0	2	3½	+	3	2	−	11½	8	7½	6/6	6/6−	P	ortho	+	−	20
17	I. J.	F	R	20	−	+2.0	+2.0	1	1½	+	4	1	−	10	7½	7	6/9	6/9	P	1 eso	+	+	13
18	L. K.	F	L	30	−	+3.5	+3.5	2	5½	−	0	2	+	13	7	6½	6/6	6/9	P	ortho	+	−	
19	J. L.	M	L	20	−	+2.0	+2.0	½	1	+	7	1	−	9½	8½	8	6/6	6/6	P	2 eso	+	+	
20	B. M.	F	L	25	−	+2.5	+2.5	Birth	1	+	3	2	−	8½	7½	7	6/12	6/18	5 exo		−	−	23
21	B. O.	M	L	30	−	+5.0	+5.0	2	2½	+	4	1	+	10½	8	7½	6/6−	6/9−	2 eso	6 eso	+	+	24
22	J. S.	F	R	35	−	E	E	4	4½	−	0	1	−	8½	4	4	6/6	6/6	P	1 eso	+	+	4
23	A. S.	M	L		−	+0.5	0	1	4	+	10	1	−	10½	6	5½	6/12	6/9	2 eso	1 eso	+	+	15
24	D. T.	F	Alt	15	−	+1.75	+1.75	½	3	−	4	2	−	10	7	6½	6/6	6/9	30 exo		−	−	14
25	J. T.	F	L	20	−			Birth	1		7	1	−	8½	7½	7	6/9	6/18	P	1 eso	−	−	14
26	A. W.	F	Alt	10	+	E	E	½	2½		0	2	−	10½	7½	7½	6/9	6/9	P	3 eso	+	−	19
27	G. W.	F	Alt	45	−	+5.0	+5.0	½	2	+	0	1	+	11½	9	7½	6/12+	6/9	1 eso	4 eso	+	−	12
28	L. W.	F	L	30	−	+2.5	+2.5	2	4	+	4	1	−	12½	8½	7½	6/6	6/24	1 eso		−	−	14
29	K. B.	M	L	15	−	+1.0	+1.0	3	3½	−	7	1	−	7½	4	3½	6/6	6/6	P	½ eso	+	+	10
30	L. H.	F	L	15	−	+1.0	+1.0	2	3½	−	6	1	+	9½	6	5½	6/6−	6/6−	1 eso	3 eso	+	+	14
31	T. H.	F	L	30	−			2	3½	−	6	1	+	9½	6	5½	6/6−	6/9−	P	10 eso	+	+	14
32	O. H.	M	L	10	−	+2.75	+2.75	4	4½	−	9	1	+	10½	6	5½	6/9+	6/12+	P	ortho	+	+	10
33	L. J.	F	R	15	−	E	E	Birth	2½	−	4	2	+	10	7½	7	6/9	6/9	7 exo	7 exo	+	+	19
34	J. L.	F	R	20	−		+1.0	Birth	2	−	5	1	−	9½	7½	7½	6/36	6/9	3 eso	3 eso	+	+	27
35	P. L.	M	L	20	−	E	E	Birth	4½	−	6	1	+	9½	4	4	6/9+	6/18+	P	7 eso	+	+	14

In the table place is given only to horizontal deviation and phorias at last examination. A vertical deviation or phoria was present in the following cases:

Vertical tropia: 18. L 2 hypo. 40. L 5 hyper. 44. Slight alt. hyper. 54. L 1 hyper. 64. L 5 hyper. 68. R 2 hyper. 74. L 2 hyper. 82. R 1 hyper. 99. L 2 hypo.

Vertical phoria: 1. R 2 hypo. 10. R 1 hypo. 11. R 4 hypo. 18. L 1 hypo. 26. Alt. 1 hyper. 32. L 1 hyper. 33. R 2 hypo. 44. Alt. hyper. 45. L 1 hypo. 46. Alt. hyper. 48. R 1 hyper. 54. L ½ hypo. 82. Alt. 2 hyper. 91. L 2 hyper. 92. R 3 hyper. 112. L 2 hypo.

TABLE 1—*Continued*

No.	Name	Sex	Eye	Angle	Vertical component	Spherical refraction (atropine) R	Spherical refraction (atropine) L	Age, onset of squint (yr.)	Age, first therapy (yr.)	Correcting glasses	Preop. period with occlusion (mo.)	No. op.	Prism glasses	Last Observation: Age (yr.)	Total observation (yr.)	Observed since last op. (yr.)	Visual acuity R	Visual acuity L	Position, horizontal if necessary with glasses	Phoria, horizontal if necessary with glasses	Fusion	Depth perception	Total no. consultations
36	L. N.	F	L	15	–	+2.0	+2.0	3¼	3½	–	5	2	–	9¼	6¼	5½	6/6	6/6	P	ortho	+	–	11
37	O. N.	M	L	45	–	+2.0	+2.0	4	4½	–	4	1	–	7½	3	2½	6/6	6/9	P	2 eso	+	+	8
38	T. N.	M	Alt	30	–	+3.0	+3.0	1½	2½	+	5	1	+	10	7	6½	6/9 –	6/9 –	P	2 exo	+	+	15
39	R. O.	M	R	30	–	+2.5	+2.0	3	5	+	5	2	–	14	7½	7	6/12 +	6/6	P	2 exo	+	+	24
40	A. P.	F	R	25	–	+1.0	+1.0	1	1½	–	3	3	–	7½	6½	5½	6/9 –	6/12 –	5 eso		–	–	28
41	S. P.	F	L	30	–	+2.0	+3.0	Birth	3	–	21	2	–	10	7	5	6/9 +	6/9 +	2 eso		–	–	20
42	E. R.	F	L	20	–	+4.5	+6.0	3¼	3½	+	0	1	–	12	8	6½	6/6	6/24 +	P	½ exo	+	–	12
43	O. R.	M	L	30	–	E	E	2	2½	–	6	1	–	6	3½	3½	6/9 +	6/9 +	P	1 eso	+	–	11
44	S. S.	M	R	20	–	+1.0	+1.0	1½	2	–	6	4	–	9½	7½	1½	6/9	6/9	P	1 eso	–	–	25
45	E. S.	M	R	45	–	+3.5	+3.5	1½	2	+	9	2	+	9	7	4½	6/9 –	6/24 –	P	2 eso	+	–	22
46	T. S.	F	L	10	–	+1.75	+1.75	Birth	1½	–	12	2	+	8½	7	3½	6/9	6/9	1 eso	ortho	+	–	21
47	H. T.	M	L	30	–	+1.0	+1.0	1	2	–	6	2	–	8½	6½	5½	6/6	6/36	1 eso	3 eso	+	–	17
48	P. W.	M	L	40	–	+1.5	+1.5	½	1½	+	32	1	–	10	8½	6½	6/9 +	6/9 +	P	ortho	–	–	12
49	B. W.	F	R	30	–	E	E	1	2½	–	7	2	–	9½	7	6	6/6	6/6	15 eso		–	–	23
50	E. A.	M	R	10	–	E	E	4	5½	+	6	2	+	12½	7	5½	6/9	6/6	P	2 eso	+	+	18
51	S. A.	F	R	35	+	+6.0	+6.0	½	1½	–	6	1	–	10	8½	5½	6/9	6/9	1 exo	3 exo	+	–	26
52	T. D.	M	Alt	25	+	−1.0	−1.0	Birth	1½	–	12	1	–	8½	6½	5½	6/9	6/9	15 eso		–	–	13
53	E. E.	M	L	15	–	E	E	1½	2½	–	12	1	+	8	6	4½	6/9	6/9	1 eso	4 eso	+	+	19
54	G. F.	F	L	40	+	E	E	½	3½	–	2	3	–	10	6	5½	6/6	6/6	P	ortho	+	–	17
55	A. F.	F	L	25	–	+1.5	+0.75	2½	2½	+	12	1	–	9½	7	4½	6/9	6/9	P	1 exo	+	+	22
56	K. G.	M	R	20	–	+1.5	+1.5	3½	4	–	5	1	–	5½	1½	1	5/5	5/5	P	1 eso	+	+	7
																		Heimann					
57	O. G.	M	R	20	–	E	E	Birth	3½	–	15	1	–	12	8½	4½	6/6	6/6	P	3 eso	–	–	25
58	A. H.	F	L	30	–	+1.0	+1.0	2½	3½	–	3	1	+	8	4½	4½	6/6	6/6	P	3 eso	+	+	10
59	O. H.	M	L	20	–	+6.0	+6.0	Birth	3½	–	10	1	–	5	2	½	4/5	4/5	P		+	–	7
																		Heimann					
60	K. J.	M	Alt	20	–	+1.0	+1.0	1	2½	–	5	1	–	4½	2½	2	5/5	5/5	P	ortho	+	–	8
																		Heimann					
61	A. J.	F	R	30	–	+0.75	+0.75	½	2½	–	5	1	–	9	7	6½	6/18	6/18	P	0–3 exo	–	–	12
62	R. K.	F	L	30	+	+3.0	+3.0	½	3	–	9	2	–	9½	6½	4½	6/9	6/36	2 exo	5 exo	+	–	26
63	B. K.	F	L	35	–	+2.0	+2.0	½	2	–	10	1	–	9	7	5½	6/18	6/12	P	1 eso	+	–	13
64	K. K.	M	L	30	+	+1.0	+1.0	½	2½	–	15	1	–	7½	5	3½	6/6	6/60	15 eso		–	–	11
65	E. L.	M	Alt	30	+	+3.0	+3.0	1½	1½	+	10	1	–	8	6½	5½	6/36	6/36	P	4–8 eso	+	–	17
66	A. M.	F	L	25	–	+3.0	+2.5	1	3½	+	9	3	–	10	7	3½	6/18	6/18	P	3 exo	+	+	26
67	G. N.	F	L	30	–	+4.0	+4.0	Birth	3½	+	15	1	–	10½	7	5½	6/9	6/12	P	4 exo	+	–	24
68	G. Ny	M	Alt	15	+	+4.0	+4.0	Birth	5	+	0	3	–	10½	5½	5½	6/6	6/6	P		–	–	12
69	M. O.	F	L	30	–	+3.0	+3.0	2½	3	–	12	1	+	9½	6½	5½	6/6	6/6 –	P	7–8 eso	+	+	18
70	B. P.	F	R	30	–	+2.0	+3.0	½	2	+	6	1	+	7½	5½	4½	6/9	6/9	1 eso	ortho	+	+	14
71	E. R.	F	Alt		+	+3.0	+3.0		3½	+	0	2	–	9	5½	5½	6/6	6/6	P	3 exo	+	+	9
72	T. R.	M	L	40	+	+1.5	+1.5	½	3½	–	21	1	+	10	7	5½	6/9	6/9	P	4 eso	+	+	22
73	J. Sh.	M	L	25	–	+1.0	+1.0		6½	–	13	1	+	13	7	5½	6/6	6/6	P	5 eso	+	+	20
74	J. S.	F	R	35	–	+2.0	+2.0	Birth	1½	–	21	2	–	9	7	5	6/9	6/18	2 exo		+	–	24
75	O. S.	F	R	30	–	+1.0	+1.0	Birth	3	–	3½	1	+	8½	5½	5	6/12	6/9	P	1 eso	+	–	12
76	E. S.	M	L	35	–	+1.0	+2.5	1	3	–	8	1	–	7	4	3½	6/9	6/12	P	6 eso	+	–	13
77	P. S.	M	Alt	30	+	+1.0	+1.0	Birth	½	–	12	2	–	7½	6½	5	5/5	5/5	5 eso		–	–	21
78	G. S.	F	Alt	15	–	+1.5	+1.5	3	3½	–	5	2	+	8½	5½	2½	6/9	6/9	P	variable	+	+	18
79	S. T.	F	Alt	35	–	+1.0	+1.0	1	4	–	2	2	–	10	6	½	6/6	6/6	P	1 eso	+	+	12
80	M. O.	F	L	30	–	+6.0	+6.0	2	4	+	9	1	–	6½	3	2½	6/9	6/18	P	ortho	+	–	12
81	O. Aa.	M	R	10	–	+2.0	+2.0		6½	–	5	2	+	12½	6½	2½	6/6	6/6	P	5 eso	+	+	15

TABLE 1—*Continued*

No.	Name	Sex	Eye	Angle	Vertical component	Spherical refraction R	Spherical refraction L (atropine)	Age, onset of squint (yr.)	Age, first therapy (yr.)	Correcting glasses	Preop. period with occlusion (mo.)	No. op.	Prism glasses	Last Observation: Age (yr.)	Total observation (yr.)	Observed since last op. (yr.)	Visual acuity R	Visual acuity L	Position, horizontal if necessary with glasses	Phoria, horizontal if necessary with glasses	Fusion	Depth perception	Total no. consultations
82	R. A.	M	L	30	–	+2.0	+2.0	1	3½	–	7	1	+	9½	6	5	6/6	6/6	P	3 eso	+	+	16
83	E. B.	M	R	30	–	+1.0	+1.0	Birth	1½	–	12	1	–	7	5	4	6/9	6/12	30 eso		–	–	14
84	T. E.	M	L	20	–	+2.0	+2.0	2½	3	–	5	2	–	7½	4½	½	6/6	6/6	P	4 eso	+	+	19
85	J. G.	M	Alt		+	+4.0	+4.0	3½	3½	+	10	1	+	10	6	5½	6/6	6/6	P	ortho	+	+	
86	M. H.	F	L	35	–	+1.5	+1.5	Birth	4½	–	10	1	+	9½	5	4½	6/9	6/18	1 eso	5 eso	+	+	13
87	E. J.	M	L	20	–	+1.0	+2.0	½	1½	–	15	2	+	6½	5	1½	6/5	5/5	1 eso		+	+	16
88	H. G.	M	L	35	–	+3.5	+2.5	½	4	+	5	2	–	9	5	2½	6/9	6/9	1 eso	1 eso	+	+	17
89	G. L.	F	R	10	–	+1.0	+1.0		3½	–	13	1	–	9	5½	5½	6/9	6/6	5 eso		+	+	16
90	F. M.	M	L	30	–	+7.0	+7.0	2½	2½	+	5	1	–	9	6½	4	6/9	6/12	P	4 eso	+	–	13
91	T. M.	M	L	30	–	+7.0	+7.0	1	2½	+	5	1	–	9	7	4	6/9	6/9	P	2 eso	+	–	13
92	P. M.	M	R	20	–	+1.5	+1.5	2	4	–	11	2	+	9½	5	3	6/6	6/6	2 eso	5 eso	+	+	18
93	A. N.	F	L	25	–	+1.5	+1.5	1	1½	–	30	1	+	8	6½	4½	6/6	6/9	5 eso		–	+	17
94	F. O.	M	L	15	–	+2.5	+3.0	½	1½	–	5	2	+	6½	5½	1½	5/5	5/5	P	2 eso	+	–	19
																		Sjøgren					
95	M. O.	F	L	15	–	E	E	4	5½	–	0	1	+	9½	4	3½	6/9	6/9	P	7 eso	+	+	8
96	A. O.	F	R	15	–	+2.0	+1.0	2	4½	–	18	1	+	6½	5	3½	6/6	6/6	P	9 eso	+	+	12
97	P. S.	M	L	15	–	+4.0	+6.0	½	2	+	10	1	–	7½	5½	4½	5/5	5/5	P	½ eso	+	–	19
98	H. S.	M	Alt	30	+	+4.0	+4.0	1½	2	+	14	3	–	8½	6½	2½	6/9	6/9	P		–	–	20
99	R. S.	M	Alt	30	+	+1.5	+1.5	4	5	–	6	2	–	9½	5	2½	6/6	6/6	2 eso		+	–	10
100	A. S.	F	L	20	+	+3.0	+3.0	2½	2½	+	21	1	–	9½	7	5½	6/9	6/9	P	3 eso	+	+	14
101	O. A.	M	R	30	–	E	E	Birth	4½	–	9	2	+	8	3½	1½	6/18	6/9	P	3 eso	+	–	9
102	T. B.	F	L	20	–	+4.0	+4.0	2	5½	+	10	1	–	9	4	3	6/9	6/9	P	2 eso	+	+	14
103	K. B.	F	Alt	15	–	+4.5	+4.5	4	4½	–	15	1	+	10	6	4½	6/9	6/9	P	2 eso	+	+	16
104	P. B.	M	R	30	–	+5.0	+5.0	Birth		+	18	1	–	5½	4½	3	5/5	3/5	8 eso		–	–	17
105	T. H.	F	L	20	–	+1.0	+1.0	2½	3	–	8	2	+	7½	4½	2	6/9	6/9	P	3 eso	+	+	19
106	E. H.	F	R	30	–	+2.0	+2.0	3	4	–	21	1	+	8	4	2½	6/18	6/9	1 eso	1 eso	+	–	14
107	K. H.	M	L	40	–	+4.0	+4.5	Birth	4½	+	10	1	–	9	4½	3½	6/9	6/9		0–4 eso	–	–	12
108	H. K.	M	R		–	+1.0	+1.0	5	5½	–	30	1	+	9½	5	2½	6/6	6/6	P	1–5 eso	+	+	18
109	J. K.	M	L	25	+	+0.5	+0.5	½	3½	–	12	2	–	7½	4	2	5/5	5/5	5 eso		–	–	12
																		Sjøgren					
110	G. K.	F	L	20	–	+1.0	+1.0	2½	3	–	5½	1	+	4½	1½	1	7/5	7/5	P	4 eso	+	–	8
																		Heimann					
111	B. K.	M	R	15	–	+2.0	+2.0	½	1½	+	12	1	–	8½	7	3½	6/9	6/12	P	3 eso	+	–	29
112	J. M.	F	L	30	+	+5.0	+5.0	1	2	+	13	2	–	6½	4½	2½	6/9	6/9	2 eso		+	–	11
113	T. N.	F	R	30	–	+2.0	+2.0	2	2½	+	12	2	+	7	4½	½	4/5	6/5	3 exo	3 exo	+	–	13
																		Sjøgren					
114	U. Ro.	F	R	30	–	+1.0	+1.0	4	4½	–	8	1	–	8	4	3½	6/9	6/9	P	9 eso	+	+	10
115	U. Ro.	F	R	30	–	+0.5	+0.75	Birth	2½	–	12	1	–	8	5	4	6/12	6/9	P	2 eso	+	+	13
116	E. S.	F	Alt	15	–	+2.5	+2.5	2½	3	+	9	1	–	10½	7½	3½	6/6	6/6	P	2 eso	+	+	14
117	T. T.	F	Alt	25	+	+1.0	+1.0	Birth	2	–	18	2	–	7½	5½	3	6/9	6/9	P	1 eso	+	–	19
118	R. W.	F	L	25	–	+3.0	+3.0	2	4½	+	13	2	–	8½	4½	1½	6/9	6/18	1 eso	1 eso	–	–	14
119	E. Ø.	F	L	30	–	+5.0	+5.0	1	1½	+	15	1	–	6½	5	2½	5/5	5/5	P	1 eso	+	+	17
																		Sjøgren					

are dependent only on the observation of parents. The age was stated in 116 of the 119 cases, varying from 0.0 to 4.75 years, the average being 1.5 years.

The age at which treatment was started. Treatment was started between the age of six months and six and one-fourth years the average being three years, that is, an average of one and one-half years after the stated beginning of strabismus.

Treatment

My guiding principle has been that here, as always in medicine, prevention is better than cure. With regard to squint—amblyopia prevention by means of alternating occlusion at the time when the child begins to squint is easier than improving visual acuity later.

Concerning binocular function, this ought to be regained well before the child's sixth birthday. Treatment must therefore be undertaken at an age at which the child can barely co-operate. Orthoptic treatment implies the patients co-operation and can then be started only at a time when the greatest chances for binocular function have been wasted.

My scheme of treatment has gradually assumed the following routine:

1. Occlusion treatment

Treatment by occlusion has a double purpose:

a. Prevent, cure, or improve the amblyopia.

b. Prevent or counteract such faulty coordination of the eyes as suppression, false projection, and anomalous correspondence.

Treatment should begin immediately strabismus is observed. This condition has been far from fulfilled in my cases, in which treatment was started on the average 1.5 years after the stated beginning of strabismus. On the other hand I have noticed an increasing tendency to bring squinting children to the ophthalmologist early, as the knowledge becomes more widespread that treatment will be started at once.

The mothers must be told that occlusion treatment needs to be adhered to rigidly and that occlusion treatment incompletely carried out is almost as much bother but very little use.

I have, as a rule, used adhesive tape occlusion to begin with; later and with slightly older children the plaster has in some cases been exchanged for well-fitted glasses with frosted glass for the eye to be occluded. For the eye in use, the hypermetropic patient wears a correcting lens but the emmetropic no lens for the reason that lenses occasionally mist, tempting the child to remove the glasses.

In alternating squint the period of occlusion of each eye has been a week. In monocular squinters with amblyopia the period has varied according to the degree of amblyopia but should in no case be longer than four to six weeks, since an occlusion even of this duration can bring about a temporary amblyopia of the previously sound eye to an extent which may cause the mother great alarm. Occlusion periods of the squinting eye have been followed by one week's occlusion of the sound eye.

The occlusion has preferably been continued until the eyes alternated freely, and until the visual acuity of the squinting eye was improved as much as considered possible.

It is at this point that the tests for visual acuity present great problems. Anyone who has used Heimann's pointing tests will have met with the disappointing experience that a visual acuity of 5/5 according to this test can prove to correspond to 6/18 on Snellen's test types. Sjøgren's charts (Stille, Stockholm) correspond somewhat better to Snellen.

In my material, 18 patients had no occlusion treatment before the operation particularly in the early years of this method of treatment. In two cases, occlusion was deemed ineffectual. One hundred one chil-

dren had more or less effective occlusion treatment for an average period of 9.5 months.

Before the next phase of treatment was started hypermetropics have worn glasses so long that the angle of squint can be determined with the hypermetropia corrected.

2. Surgical correction of squint

When the occlusion treatment has achieved its objectives, the time is ripe for surgical correction of the strabismus.

In cases where treatment was started during the first two years of life, I have often continued this occlusion treatment until the child has reached the age of three or four years, when examination and observation are easier. If the child at this age can relate what it sees of Dahlfeld's pictures in a stereoscope with the help of prismatic lenses of a strength corresponding to the angle of squint, I felt that I could acquire information toward the prognosis of binocular function.

On the other hand it is important that the treatment should have entered its third and final phase well before the child reaches the age of six years, as the achievement of good binocular function is much more difficult after this time.

In choosing method of operation each surgeon ought to choose a method with which he is familiar and the effect of which he has learned.

Vertical deviation requires treatment to the same extent as horizontal, and that deviation which was most pronounced was treated first. If the first operation left an esotropia of more than six degrees, a new operation has been considered necessary. I intend in my operations to leave a slight esotropia, but never of more than five or six degrees. This is because of the tendency of some eyes to diverge in the course of later school years.

My choice of operation has been affected by the fact that I have no anesthetist and therefore prefer a simple method of operation, making it possible to operate a majority of the children under local anesthesia after general premedication only.

When the angle of squint has been less than 20 degrees, I have carried out a simple recession placing the muscle back half as many mm. as there are degrees in the angle of squint. This operation has increasingly replaced a lengthening of the tendon.

When the esotropia has been 20 degrees or more, I have used a tenotomy, taking great care to leave intact the ligaments adjacent to the muscle tendon. My results show that when carried out in this way, tenotomy has left me only a moderate number of cases of insufficiency or overcorrection.

It should be emphasized that re-established binocular function is the best insurance against future alterations in the position of the eye.

When the eye was raised on adduction I performed a myectomy of the inferior oblique.

After tenotomy or recession the child was sent home without being hospitalized and continued alternating occlusion until the next consultation.

3. Exact correction of remaining angle with prisms

The next important step is to correct the remaining angle of the squint as exactly as possible with prisms in order to place the images centrally in the macula of both eyes. If the child is able to give the phoria in the horizontal and vertical plane using Maddox's rod test, this is valuable information. Otherwise I attempted by means of alternately covering and uncovering the eyes (hypermetropia corrected) to find the prism with which focusing movement stopped both horizontally and vertically.

4. Subsequent treatment and control

Control of position, balance, binocular function and visual acuity must continue throughout school age at intervals increasing

from three months to one year. An alteration in balance may require a change in the prisms. Increasing firmness of co-ordination has sometimes justified a reduction in the prismatic power even though the phoria is unchanged.

It seems to me as though a regained binocular function does not imply the same active exercise of the sight of a squinting eye as an occlusion treatment does. It has, therefore, sometimes been necessary to give occlusion treatment periodically also after the achievement of binocular function. In an unexpected failure of binocular function I have also given a period of occlusion treatment with subsequent correction of the glasses.

Results

After an average total period of observation of 6.2 years and an average period of observation after the last muscle-operation of 4.7 years I find the following:

Squint-amblyopia has been registered only:

1. With visual acuity less than 6/12.
2. With a difference of visual acuity of more than one line on Snellen's tables between the two eyes.

According to these criterias I have found uncured or incompletely cured squint amblyopia in 17 of the 119 cases with the following visual acuity on the squinting eye (Snellen's test types).

6/18 in 9 cases
6/24 in 3 cases
6/36 in 4 cases
6/60 in 1 case

Binocular function has been examined by stereoscope and with Dahlfeld's pictures for squinting children, the depth perception by stereoscope and with Sattler's pictures.

With this examination I have found:

	Cases	Percent
Binocular function with depth perception	59	49.5
Fusion without depth perception	36	30.3
No binocular function	24	20.2

Prognosis as influenced by the age of the child at the beginning of strabismus. In three out of the 119 the age of the child at the beginning of the squint is not recorded.

Out of 42 children who started squinting before the age of six months 26 obtained binocular vision (61.9 percent). Out of 74 children who started squinting after the age of six months 66 obtained binocular vision (89.1 percent).

Although we have to consider the time of onset of the squint as given by parents somewhat unreliable, these figures demonstrate clearly that the prognosis for binocular vision is much better in the cases where we may suppose that the child has had a period with binocular vision before the beginning of strabismus.

Prognosis as influenced by the interval between the beginning of the squint and beginning of therapy. In 92 children who obtained binocular function the interval was on an average 1.5 years. In 24 children who did not obtain binocular function the interval was on an average 1.9 years.

Prognosis for the accommodative and the nonaccommodative group. In hypermetropia of more than 2.0D. the strain of accommodation may be considered as an important factor in the development of convergent squint. If all cases showing a hypermetropia of 2.0D. or more are placed in an accommodative group I find:

Out of 63 accommodative cases 54 obtained binocular function (86 percent). Out of 56 nonaccommodative cases 41 obtained binocular function (73.2 percent).

These figures must be related to the age stated for the beginning of the squint. In the accommodative group 29.5 percent were stated to be squinting before the age of six months. For the nonaccommodative group this figure was 43.6 percent.

Prognosis for monocular and alternating squint. Results in binocular vision were slightly poorer in the alternating group. Out of 99 monocular cases 80 obtained binocular vision (80.8 percent). Out of 20 alternating

cases 15 obtained binocular vision (75 percent).

Prognosis as influenced by the vertical component. Among 20 cases with vertical component six have had a vertical muscle operated. The results in binocular function are slightly poorer than for the whole group.

	Depth Perception	Binocular Function without Depth Perception	No Binocular Function
Operatered on vertical muscle	4	1	1
Not operated on vertical muscle	3	6	5
	7	7	6

Relation between depth perception, age of the patient and duration of observation. It is my experience that depth perception appears later in the period of treatment than fusion. This may be caused by the stage of development of the binocular function or by the maturity of the child. My tables give a somewhat higher age (10 years) and longer time of observation (5.2 years) in the group with depth perception than in the group with fusion only (age 8.6 years, observation time 3.8 years).

In the short time since I collected my material I have found depth perception in a few children who are recorded with fusion only and I expect that in the near future others will have to be transferred to this group.

Binocular function with co-operation of one fovea with parafoveolar spot of the other eye. In several cases with binocular function and even in cases with depth perception I find that, when the leading eye is covered, the other eye must make a fixation movement of one to two degrees to fix the object.

We can clearly see that this must be a fixed co-ordination because, when we put in front of the eyes prisms of a strength expected to correct the faulty position, the fixation movement remains. In other words, both binocular function and depth perception are present in spite of an anomalous correspondence between the foveola of one eye and a point one to two degrees outside the foveola of the other eye.

In my group of 59 children with depth perception, eight had this anomaly, among them seven as an esotropia of 0.5 to 3.0 degrees, one as an hypertropia of 1.0 to 2.0 degrees.

In the group of 36 cases with fusion without depth perception 15 had this anomaly, nine as an esotropia, two as a hypertropia, four as an exotropia, all of them 1.0 to 2.0 degrees, and one as an exotropia of 5.0 regrees. Altogether this anomaly is found in 23 of the group of 95 with binocular function (24 percent).

The anomaly is more frequent in the group in which the squint started before the age of six months (40 percent compared with 19 percent among those who started squinting after this age). The interval between the start of squint and the start of treatment was two years for those who had the anomaly as compared to 1.5 years for those who had not.

The frequency was also higher among those who had arrest of squint amblyopia (40 percent compared to 12 percent among those who had not).

I want to emphasize that the binocular function, as well as the depth perception, in the patients with this anomaly appeared spontaneous and genuine. They have not gone through any orthoptic treatment with stereoscope or synoptophore and I have not been able to state any focusing movement which can explain the binocular function in these patients through rapid alternating fixation of the eyes.

I have sometimes wondered if Bangerter's and Cüppers' blinding treatment would be able to eliminate this anomaly but I find it doubtful that a spot 1.0 to 2.0 degrees outside the foveola may be blinded without blinding the center of the foveola at the same time.

Conclusion regarding pathogenesis

The treatment used in this series contains no training of a failing fusion faculty—it only offers chances of development of a

fusion faculty which has been there before. The fact that this treatment has led to binocular function in 80 percent of the cases shows clearly that the main cause of the squint in these children is to be found in the innervational—motor sphere—not in the sensory, although we cannot deny the possibility of variations as to time and degree of the reflexes on which the binocular vision is dependent. In several convergent squinters I have seen that the faculty of fusion is not only present but that it also may be rather strong.

In some of the children in my series who were operated on in the beginning of the period mentioned in this paper I did the operation only to obtain an improvement of a disfiguring squint without any hope of binocular function. The result, however, was better than expected as parallelism and binocular function appeared in spite of a rather high degree of esophoria postoperatively. Nine of the children obtained binocular vision without the help of prisms after an operation which left an esophoria of as much as 5.0 to 12 degrees.

Position of the eyes at the last examination of the 24 children who did not obtain binocular vision. When cosmetically good results are considered, there were seven cases with parallelism, six cases with esotropia below 10 degrees, three cases with exotropia below 10 degrees, and three cases with hypertropia below 10 degrees, totalling 19 cases.

Considering cosmetically unsatisfactory results, there were three cases with esotropia of 15 degrees, one case with esotropia of 30 degrees and one with exotropia of 30 degrees, totalling five cases.

In five children who obtained binocular function and two who did not, the operation led to overcorrection which necessitated a resection of the previously weakened muscle.

Summary

Ophthalmologic practice has been lax in accepting the newer views as to the causes of esotropia, the therapeutic consequence of which seems to depend on early treatment. Orthoptic treatment based on the theories of Javal and Worth of an innate lack of fusion faculty can only be applied at a time when the best chances of obtaining binocular function are gone. The treatment should begin as soon as the squint has been recognized in order to prevent amblyopia and the anomalies of binocular function caused by the squinting.

The treatment I have used is:

1. A period of occlusion treatment.
2. Surgical correction.
3. Correction of any remaining angle of squint with prisms.
4. Periodic control during the school years.

During the last 10 to 12 years I have used this therapy on children who came for treatment before the age of six years. Data concerning the 119 children treated along these lines until 1955 have been collected.

After an average total observation time of 6.2 years and an average observation time of 4.7 years after the last muscle operation the treatment has resulted in:

	Cases	Percent
Binocular vision with depth perception	59	49.5
Fusion only	36	30.3
No binocular vision	24	20.2

The prognosis in different groups of squinting children is discussed.

The conclusion is that the results in obtaining binocular function by means of this simple treatment are proof that the main cause of esotropia is to be found in the innervational—motor field—not in the sensory.

St. Torfinn's Eye Hospital.

INFLUENCE OF RETINAL ADAPTATION UPON THE PUPILLARY REFLEX TO LIGHT IN NORMAL MAN*

PART II. EFFECT OF ADAPTATION TO DIM ILLUMINATION UPON PUPILLARY REFLEXES ELICITED BY BRIGHT LIGHT

OTTO LOWENSTEIN, M.D., AND IRENE E. LOEWENFELD, PH.D.
New York

In previous work on the relations between visual sensation and pupillary responses[1,2] we described the characteristics of normal pupillary reactions to light stimuli of threshold intensity, and the effect of adaptation to bright light upon these responses. Under the conditions used in these experiments, the pupillary threshold for white as well as for red light was found to be from 0.5 to 1.5 logarithmic units higher than the subjects' visual thresholds for the same test stimuli. In all other respects, the pupillary and visual thresholds reacted similarly:

In the dark-adapted eye, the pupillary threshold was much lower for white than for red test stimuli, and pupillary threshold reactions were suppressed by light adaptation and reappeared during dark adaptation in exactly the same manner as vision; the reactions to dim white light stimuli were suppressed more profoundly and required a much longer time to be restored than the reactions to dim red test stimuli.

Because of this analogy between visual and pupillary threshold reactions it appeared possible to use the pupillary responses as objective indicators of retinal function. In the present paper, we are going to describe the normal reactions of the pupil under the converse experimental conditions, that is, the effect of adaptation to dim light upon the pupillary reflexes elicited by bright light. Under these experimental conditions, a second effect of retinal adaptation becomes manifest which is relatively independent of retinal sensitivity.

METHODS

As in the previous experiments,[1,2] the pupillogram was recorded with the electronic pupillograph,[3-5] an infrared-sensitive scanning device which furnishes accurate, continuous traces of the simultaneous movements of both pupils in complete darkness or at any level of light adaptation.

The subjects' eyes were adapted to darkness or to dim light (cf. later). Intermittent light stimuli of 1/10 second or of one-second duration were presented in four-second cycles, that is, with three-second dark-intervals between one-second stimuli and with 3.9-second dark-intervals between 1/10-second stimuli. The Sylvania glow modulator tube was used as described before,[1,2] except that the white light flashes were held at a constant "standard" intensity of 20 percent of the full brightness of the Sylvania tube. This intensity was roughly nine log units above the subjects' absolute visual threshold.

Adaptation to dim light was done in several ways:

1. *Adaptation of the homolateral (stimulated) eye alone.* The Sylvania tube was used with DC current of 0.34, 0.8 or 1.6 ma. Under these conditions, the tube furnishes an orange-yellow light beam of approximately 0.1 percent (0.34 ma.) to 0.5 percent (1.6 ma.) of full intensity. An exact comparison of this light intensity with that of the bright stimulating light flashes is not possible because of (1) the difference in color and (2) the difference between a flashing and a constant light. The approximate values here given were determined by comparison of visual thresholds. Since we used the same

* From the Department of Ophthalmology (Laboratory of Pupillography), Columbia University College of Physicians and Surgeons, and the Institute of Ophthalmology, Presbyterian Hospital. This work was supported by the Harriman Fund and by a grant from the U.S. Public Health Service (Sens. Dis. B-253).

tube as source for both the stimulating light flashes and the dim adapting light, 0.1 percent was the lowest intensity of adapting light available in this experiment. The Sylvania tube will not light with currents lower than about 0.34 ma.

2. *Bilateral background illumination.* Dim bilateral background illumination was provided in three different ways:

a. A 20 by 20 mm. area was illuminated by a two-volt lens-tip flashlight bulb and concave silvered reflector (fig. 1-A, *a*, *b*). The light was diffused by two layers of white bond paper (*c*), and the infrared part of the spectrum was absorbed by 2.0-percent copper chloride solution in a 15 mm. deep pyrex cell (*d*).

The luminous area was placed at a distance of five inches in front and below the subject's nose, at an angle of about 35 degrees below the visual axis. Light intensity, controlled by rheostat, was found to be about 4.5 logarithmic units above the subject's absolute visual threshold.

b. A milk-glass plate, 92-mm. wide and 33-mm. high (fig. 1-C, *a*), was illuminated evenly by three flashlight bulbs (*b*). The milk-glass plate intersected the line of vision at an angle of 70 degrees, so that its apparent size was 84 by 33 mm. The distance to the subject's eye was 15 inches. A small black cross in the center of the luminous area served as fixation mark, while the dim green or red triangular fixation light which was used during experiments performed in darkness (*c*), was reflected into the line of vision by a mirror (*d*) and by the anterior surface of the milk-glass plate. The intensity of the milk-glass background was adjusted by rheostat and was about 3.5 log units above visual threshold.

c. A white field, attached to the ceiling, was seen by the subject via a mirror. The background covered 30 degrees of the visual field horizontally and 15 degrees vertically. It was illuminated from below by a 7.5-watt tungsten bulb, placed at a distance of six feet and covered by a round filter cell of 65-mm. diameter, filled with $CuCl_2$ solution. It could just be seen through gray filters of $10^{-3.5}$ transmission.

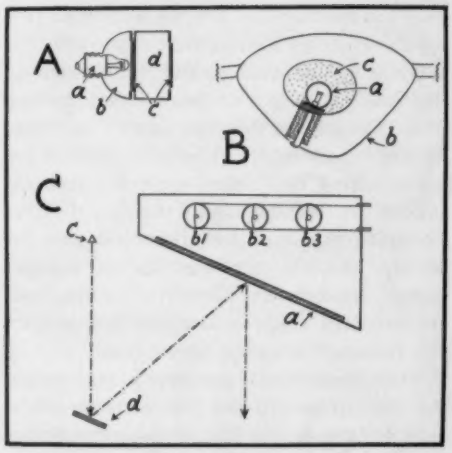

Fig. 1 (Lowenstein and Loewenfeld). Different light sources used for dim background illumination. The lights (A) and (C) were used for bilateral background illumination, the eye-patch-lamp (B) for adaptation of the contralateral, consensually reacting eye. The intensity of all lights was controlled by rheostat.

(A) *a* = flashbulb; *b* = concave, silvered reflector; *c* = white bond paper for light diffusion; *d* = filter cell, filled with two-percent copper chloride solution to eliminate infrared light.

(B) The eyepatch lamp, as seen by the subject. The flashbulb *a* (green bead) and screw base were fastened to the eyepatch by a clip. The bulb is visible through an oval cut-out in the eyepatch. A reflector of crumpled aluminum foil (dotted area *c*) and black masking tape close the eye-patch to the outside and hold the flashbulb securely in place.

(C) The milk-glass lamp is seen from above. a = milk glass plate of 92 by 33 mm.; *b 1* and *b 2* = GE no. 47 flashlight bulbs (brown bead, 0.15 ma., 0.9 W); *b 3* = GE no. 44 flashlight bulb (blue bead, 0.25 ma., 1.5 W); *c* = dim triangular light spot used as fixation mark in experiments in which the milk-glass lamp was turned off. A green or red filter was used for this light, which was reflected into the line of vision by a mirror *d* and the anterior surface of the milk glass plate.

3. *Adaptation of the heterolateral (nonstimulated) eye alone.* In some experiments, the eye opposite to the one which was exposed to the intermittent light flashes was adapted to light. A three-volt flashlight bulb (green bead, fig. 1-B, *a*), contained in a black eye patch (*b*) and surrounded by a layer of crumpled aluminum foil (*c*) was

used for the purpose. For the weaker of two light intenstities used in these experiments, a rheostat was adjusted so that the filament of the bulb just began to show a dark orange glow. The subject then saw many dim, intersecting orange circles of light which filled the entire visual field; they were the entoptic images of the highlights formed by the crumpled aluminum foil. For the higher intensity, the filament was burned orange-yellow. No light was allowed to escape from the eyepatch lamp, so that the contralateral eye remained in complete darkness.

The experiments specifically undertaken for the purpose of the present communication were done on 20 normal subjects between the ages of 17 and 50 years. Three sets of identical twins were included in this number. Furthermore, a bilateral dim background illumination test (methods 2-a, b or c) was done on 172 patients with lesions at various sites within the nervous network of pupillary control. Our general statements are based, in addition, on our entire pupillographic material, as summarized in publications 3 and 4.

Results

A. Pupillary reflexes of the dark-adapted eye (normal variability)

The parasympathetic reflex arc for the pupillary reaction to light is well known. When the eye is exposed to light, afferent impulses from the retina travel via the optic nerve, chiasm and tracts to reach the pretectal area of each side in the anterior dorsal midbrain. The intercalated pretectal neurones transmit the stimulus to the homolateral and the heterolateral Westphal-Edinger nuclei. The efferent parasympathetic impulses run via the third nerve, the ciliary ganglion and the short ciliary nerves to innervate the iris sphincter.

It is important to note that the parasympathetic reflex arc is not an isolated structure; its function is influenced by mechanisms from higher brain centers.[6] Elicited by sensory stimuli other than light, by emotions such as, for example, fear or anxiety, or even by spontaneous thoughts of the individual, cortico-thalamic-hypothalamic mechanisms come into play and influence the pupil in two ways:

1. Active pupillary dilator impulses travel to the eye via the cervical cord and the peripheral sympathetic chain; they innervate the pupillary dilator muscle which acts antagonistically to the pupillary sphincter.

2. Simultaneously, inhibitory impulses reach the Westphal-Edinger nucleus from cortex, thalamus and hypothalamus and reduce or suppress the parasympathetic outflow.

The pupillary light reflex thus depends not only upon the condition of adaptation of the retina, and upon the duration and intensity of the light stimulus, but also upon the degree of supranuclear inhibition of the oculomotor nucleus present at the moment of stimulation.

The degree of supranuclear inhibition varies between subjects and in the same subject under different conditions:

1. When the normal subject is exposed to sensory stimuli such as discomfort, pain or noise, or when exciting thoughts or emotions are elicited, the pupils become larger than when the subject is calm, and the pupillary reflex to light is inhibited. The pupillary contraction is reduced in extent and speed, and premature redilatation may appear. When, however, the same subject is tired, the pupil is relatively small in darkness; the contraction to light is slightly faster, and redilatation in darkness is less vigorous, than when the subject is rested.

2. In tense, hyperexcitable but otherwise healthy subjects, the pupil of the dark-adapted eye is always large, and the light reflex is less extensive than in calm subjects, even when no immediate reason for excitement exists and when the subject sits comfortably and apparently calmly in the darkened room (fig. 2, dotted line). Conversely,

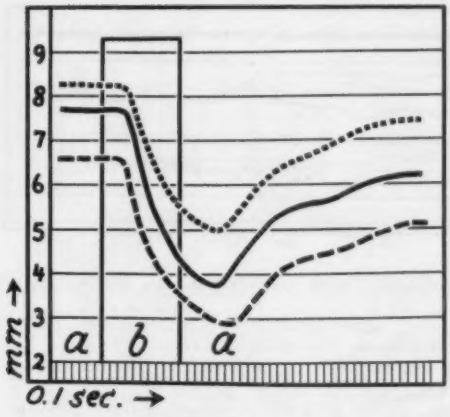

Fig. 2 (Lowenstein and Loewenfeld). Pupillary reactions to light in three normal subjects.

Pupillary diameter is recorded as the ordinate (in mm.) against time as the abscissa (in 0.1 second units). At *a*, the eyes were in darkness; during the time *b*, one eye of the subject was exposed to light of "standard" intensity (cf. Methods).

The *solid line* shows the pupillogram of a normal, calm, well-rested subject (B), a 24 years old woman. The *dotted line* represents the reaction of a tense, excitable subject (A), a young woman, 22 years of age. She was in good health but often felt tense and irritable for days, without apparent reason, and had difficulties falling asleep at night. Even when tired, she never grew drowsy during lengthy pupillographic tests. The *broken line* shows the reflex of a hyperfatigable 36-year-old man (C). He was generally healthy but was always tired because he seldom slept more than five hours a night in order to satisfy the demands of family, full-time work and additional evening studies. During pupillographic tests, he usually fell asleep within about 10 minutes unless kept awake by constant conversation.

The light reflex was slightly inhibited in subject A and slightly depressed in Subject C (further description in the text).

in hyperfatigable, otherwise healthy subjects, the pupil is usually smaller in darkness than in less fatigable normal persons. Even in the absence of unusual tiredness, the contraction to light is slightly accelerated in such subjects while pupillary redilatation is incomplete. When several light stimuli are presented in succession, the pupils of the hyperfatigable subject rapidly become much smaller than they had been in darkness, and the light reflexes show "fatigue shapes" prematurely.[6]

B. Pupillary movements in response to dim, steady light (normal variability)

When one or both of the subject's eyes are exposed to a steady, continuous light, the pupils contract, then redilate partially and begin to oscillate. As already described,[2] these oscillations, often called "pupillary unrest" or "hippus," are found in all normal subjects and continue indefinitely when the stimulating light is strong; when it is weak, they gradually decrease in frequency and amplitude during retinal light adaptation.

All of the various light sources used in the present experiments to illuminate one or both of the subjects' eyes had similar effects. The pupillary reactions depended upon the relative brightness of the light stimuli alone. There were, however, distinct differences between the pupillary movements of different subjects, elicited by the same type and the same intensity of illumination. As an example, Figure 3 shows the pupillary movements of subjects A, B and C of Figure 2, recorded during adaptation to dim, steady light. When the light was turned on, the immediate pupillary contraction was smaller in the tense, excitable Subject A, and greater in the hyperfatigable Subject C, than in the calm, rested Subject B. The pupillary oscillations were inextensive in Subject A; they disappeared almost completely during the course of light adaptation while the pupil redilated to nearly the same diameter it had shown in darkness. In contrast, the oscillations remained active, and the pupil remained small, in the hyperfatigable Subject C.

These differences in the pupillary responses to dim illumination which were shown by various subjects were only quantitative in nature: The same intensity of illumination produced a greater effect when the subject was tired and a lesser effect when the subject was tense. Similarly, the same pupillary effect could be elicited at will in all subjects, in the excited subject by increasing the light intensity and in the fatigued subject by decreasing the light intensity.

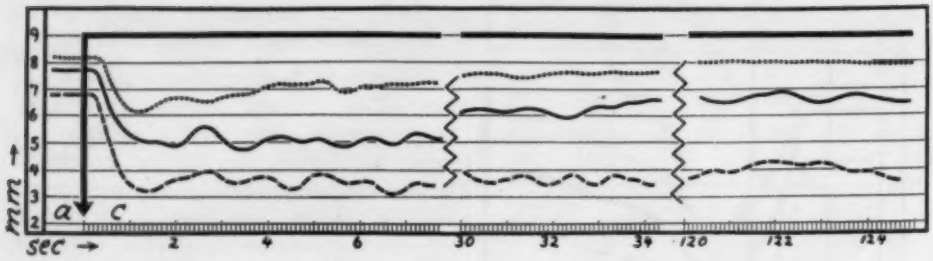

Fig. 3 (Lowenstein and Loewenfeld). Pupillary movements during adaptation to dim, steady light in three normal subjects.

Pupillary diameter is recorded as the ordinate (in mm.) against time as the abscissa (in 0.1 second units). At *a*, the eyes had been adapted to darkness for 30 minutes. During the time framed by the arrow *c*, both eyes of the subject were exposed to dim, steady blue-green light (cf. Methods, 2a). The reactions of the same three normal subjects used in Figure 1 are shown.

Solid line, Subject B. When the dim light was turned on, the pupil contracted and began to oscillate. With increasing retinal adaptation, the oscillations became shallower and slower, and the mean diameter of the pupil increased.

Dotted line, Subject A. In this tense and excitable but otherwise normal subject the initial contraction to light was smaller, the following oscillations slower and less extensive than in Subject B. After light adaptation, the pupil became almost as large and quiet as it had been in darkness.

Broken line, Subject C. In the hyperfatigable Subject C, the initial contraction was extensive, the following oscillations vigorous and sustained; they continued, and the pupil failed to redilate, even after prolonged light adaptation.

The pupil of the excitable Subject A was, thus, less sensitive to dim light than the pupil of the calm Subject B, while the hyperfatigable Subject C reacted excessively to dim illumination. This fact is shown also in Figures 4, 5, and 6. While all three subjects reacted extensively to bright light, the response to dim illumination was more pronounced in the hyperfatigable Subject C than in the others. During light adaptation, the pupil redilated early and extensively in Subject A but it remained small in Subject C, even when the adapting light was dim. During adaptation to strong light, the pupillary

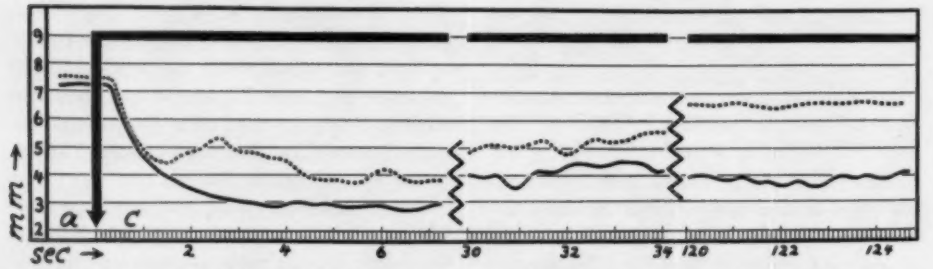

Fig. 4 (Lowenstein and Loewenfeld). Pupillary movements in dim and in strong light: Subject B.

Pupillary diameter is recorded as the ordinate (in mm.) against time (in 0.1- and in 1.0-second units). At *a*, the subject's eyes had been adapted to darkness for 30 minutes. During the time outlined by the arrow *c*, the right eye was exposed to bright, steady light of "standard" intensity (solid line) or of approximately 1/1000 of "standard" intensity (dotted line, cf. Methods, 1).

Solid line. When the eye was exposed to bright light, the pupil contracted strongly, then redilated slightly, while fast pupillary oscillations appeared. These oscillations persisted, and the pupil remained small, as long as the light stimulus continued.

Dotted line. When the light stimulus was dim, the initial pupillary contraction was less extensive and pupillary oscillations appeared earlier. During light adaptation, the pupil redilated and became relatively quiet.

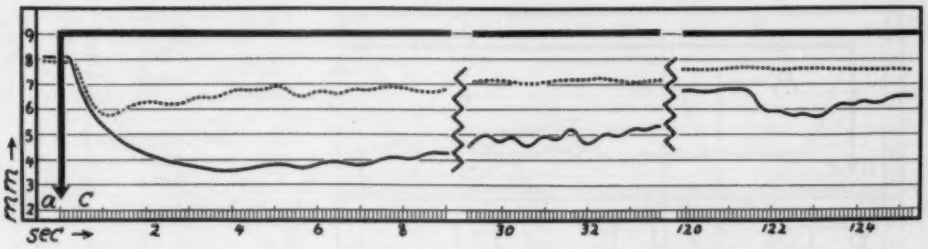

Fig. 5 (Lowenstein and Loewenfeld). Pupillary movements in dim and in strong light: Subject A. The conditions of the experiment were the same as described for Figure 4.

Solid line. In response to bright light the pupil contracted strongly; it redilated earlier and more extensively than in Subject B (fig. 4). Pupillary oscillations persisted as long as the eye was exposed to light.

Dotted line. When the adapting light was dim, the initial pupillary contraction was less extensive and redilatation almost complete. In the tense, excitable Subject A, the difference between the immediate pupillary effects of bright and of dim light was greater than in the calm Subject B.

oscillations remained active in all three subjects. When the adapting light was dim, the oscillations became shallower and slower in Subject B, and disappeared altogether in Subject A, but continued unchanged in Subject C.

C. Influence of adaptation to dim light upon pupillary reflexes elicited by bright light

The pupillary reflexes elicited by bright light after dark adaptation were compared with pupillary reactions to the same light stimuli in the presence of the dim adapting light. Figure 7 serves as an example. In the first line, Subject C's pupillary movements during the first 12 seconds of adaptation to a steady light of about 0.1 percent of "standard" intensity are shown. As was usual for this subject, there was a strong contraction, followed by vigorous oscillations and relatively inextensive redilatation of the pupil. In the second line, pupillary light reflexes, elicited by three successive one-second stimuli of "standard" intensity are shown (1) after dark adaptation (solid line) and (2) after five minutes of adaptation to the dim background light (broken line). In this hyper-

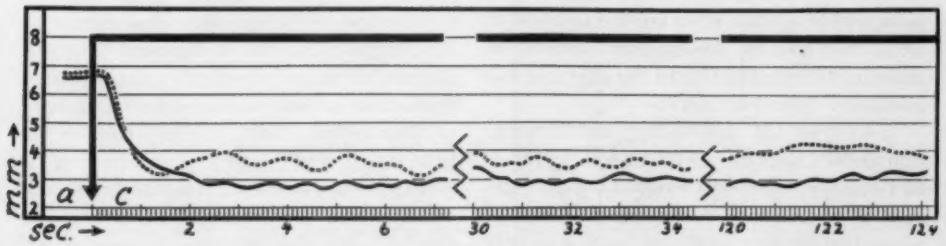

Fig. 6 (Lowenstein and Loewenfeld). Pupillary movements in dim and in strong light: Subject C. The same experimental conditions were used as in Figures 4 and 5.

Solid line. In response to bright light the initial pupillary contraction was strong, the following oscillations fast. The pupil failed to redilate during light adaptation.

Dotted line. When the eye was exposed to dim light, the pupil contracted extensively; during light adaptation, it redilated only slightly, and oscillations continued throughout the experiment.

The difference between the pupillary effects of dim and of bright light was much smaller in Subject C than in the calm, rested Subject B or the tense Subject A.

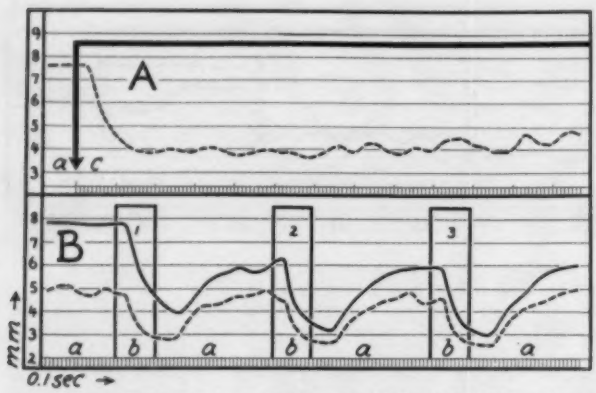

Fig. 7 (Lowenstein and Loewenfeld). Effect of dim illumination upon the pupillary reactions to bright light: Subject C.

First line (A). The pupillary effect of dim, continuous light is shown. The experimental conditions were the same as in Figures 4, 5, and 6 (dotted lines). In response to dim, steady light, the pupil contracted strongly, then redilated slightly and continued to oscillate.

Second line (B). The solid line shows the reactions of the subject's dark-adapted pupil to three successive light stimuli of 1 second duration and of "standard" intensity. The broken line shows the same subject's pupillary responses to the same light stimuli after five minutes of adaptation to the dim illumination used in Experiment A (first line). Note the small initial pupillary diameter and the inextensive, relatively fast, square-shaped light reflexes (cf. text).

fatigable subject, the dim background light had a profoundly depressing effect upon the pupil. The initial pupillary diameter and extent of the reflexes were much reduced, while the reflex shape resembled the relatively fast, square, "tonohaptic" reflex pattern found as a permanent, nonreversible symptom in cases with clinical or experimental lesions in the diencephalic centers which normally inhibit the Westphal-Edinger nucleus.[6] In the hyperfatigable Subject C, this supranuclear inhibition was always weaker than in well-rested normal and in excitable persons. After adaptation to darkness, the pupillary reflex to light was found to be within normal limits but the addition of weak background illumination sufficed to make a functional defect of the supranuclear inhibitory system manifest.

In contrast, the same background illumination did not have much effect upon the pupillary reactions of the well-rested normal Subject B (fig. 8-B). After five minutes of adaptation to dim light, the pupil was only one mm. smaller than it had been in darkness and the light reflexes with and without the adapting light were nearly alike.

The pupillary diameter of Subject A was even larger than in Subject B after adaptation to the dim background light, while the light reflex, far from being reduced, actually became enhanced by the presence of the dim background light. The enhancing effect was slightly more pronounced when the stimulating light flashes were weaker than when they were stronger (fig. 9).

D. Mechanism of the effect of dim illumination upon the pupillary light reflex

When we considered the possible mechanism of the influence of dim illumination upon the pupillary light reflexes, it was, from the outset, not likely that this influence could result from retinal adaptation, that is, from a reduction of retinal sensitivity caused by adaptation to the dim background light. Reduction of retinal sensitivity, just as reduction of the intensity of the stimulating light, or impairment of the afferent path of the light reflex, would lead to pupillary "low intensity" reactions with a long latency period, small extent, slow speed and short duration.[1,2,7] But the reflexes obtained in the presence of dim background illumination were always fast, with a slightly shortened latency period, and, as seen in Figures 8-A and 9, in some cases of even greater extent than reactions to the same light stimuli after dark adaptation.

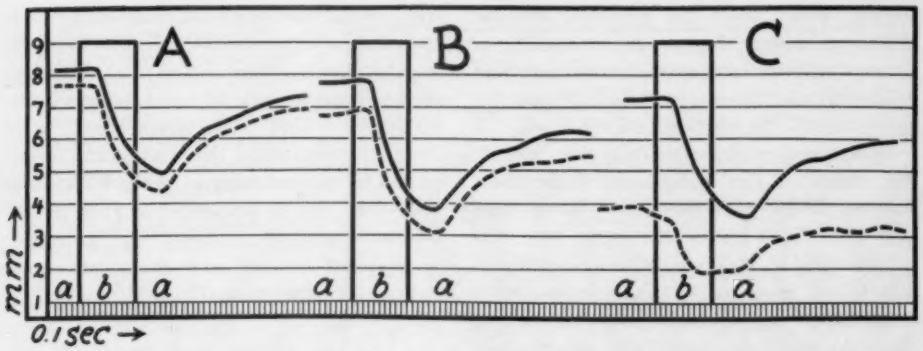

Fig. 8 (Lowenstein and Loewenfeld). Effect of dim illumination upon the pupillary reaction to bright light. Subjects A, B, and C.

Pupillary diameter is recorded as the ordinate (in mm.) against time as the abscissa (in 0.1 second units). At *a*, the eyes were adapted to darkness (solid lines) or to dim blue-green illumination (broken lines, cf. Methods, 2-a). During the one-second intervals *b*, light stimuli of "standard" intensity were presented.

A. In the tense, excitable Subject A, the pupil was only slightly smaller after adaptation to dim light than it had been in darkness. The reflex elicited by the one-second bright light flash was slightly enhanced after adaptation to dim light.

B. In the well-rested, calm Subject B, the difference between the pupillary diameters in darkness and after adaptation to dim light was greater than in subject A; the light reflex was slightly reduced after light adaptation.

C. In the fatigable Subject C, adaptation to dim light had a profoundly depressing effect. The pupil became quite small, the light reflex inextensive and pathologic in shape (cf. text).

It appeared likely that the effects of dim background illumination were brought about by a central nervous mechanism which affected the degree of supranuclear inhibition of the Westphal-Edinger nucleus.

In the normal state of wakefulness, the autonomic balance is at an optimum for the production of extensive light reflexes,[6] and slight weakening of supranuclear inhibition has only little effect. On the other hand, in tired subjects with weak supranuclear inhibition, the background light shifts the auto-

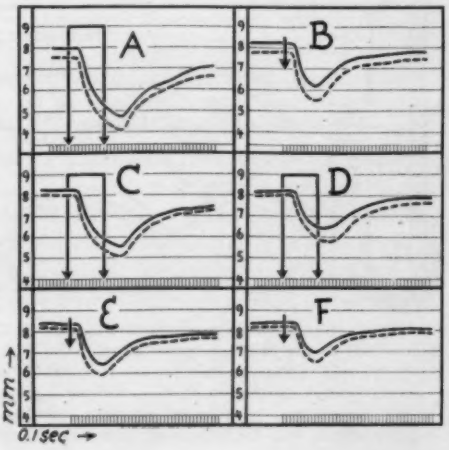

Fig. 9 (Lowenstein and Loewenfeld). Effects of dim illumination upon pupillary light reflexes: Subject A.

In each of the Experiments A through F, pupillary diameter was recorded as the ordinate (in mm.) against time as the abscissa (in 0.1 second units), whereby the solid lines represent the pupillary reactions of the dark-adapted eye, the broken lines those after adaptation to dim blue-green illumination (cf. Methods, 2a). The arrows and double-arrows mark the time of presentation of short (1/10 second) or of longer (one second) light stimuli. The following stimulus intensities were used: A,B = "standard" (cf. Methods); C,E = 1/100 and D,F = 1/1000 of "standard" (reduced by neutral gray filters).

In all experiments, adaptation to dim light enhanced the pupillary reflexes. The enhancing effect was slightly more noticeable when the stimulating light was weaker (D,F) than when it was brighter.

nomic balance from the optimum, and the reactions become depressed; conversely, in excited subjects with excessive supranuclear inhibition, the balance is shifted toward the optimum and the reactions are enhanced.

It was proven experimentally that, indeed, the effects of dim background illumination are central nervous in nature. When only one eye, for example the right one, was adapted to dim, steady light, and the left eye, which had remained in darkness, was then exposed to intermittent flashes of bright light, the pupillary reactions were influenced in the same manner as when the background and the stimulating lights were placed on the same eye (figs. 10 and 11). Since, then, adaptation to dim light of the consensually reacting opposite eye could cause the same changes in the light reflex, these changes could not be due to a reduction in sensitivity of the retina of the stimulated eye but must be caused by a central nervous mechanism.

It is interesting to note that repeated elicitation of the light reflex had a similar effect on the reflex pattern as the dim background illumination. For example, in Figure 11-B, the third of three consecutive light reflexes elicited in darkness (solid line) was similar to the first reaction in the presence of weak contralateral adapting light (broken line), while the third reaction with weak contralateral light resembled the first one with brighter illumination (dotted line). We have shown in previous work[6,8] that changes in the shape of the light reflex which appear upon repeated elicitation of the reaction can be enhanced by general fatigue of the individuals while they can be prevented or reversed by psycho-sensory stimulation of the subject, or by electrical stimulation in the cortex or interbrain of experimental animals.

Summary and Conclusions

Adaptation to light affects the normal pupillary light reflex in two ways:

1. It reduces the sensitivity of the retina. When the adapting light is strong and the stimulating light flash weak, the reduction of afferent impulses due to light adaptation may reduce or even abolish the light reflex. But when the adapting light is weak and the stimulating light flash strong, the loss of retinal sensitivity has no significant influence on the development of the light reflex.

2. Adaptation to dim light alters the functional state of the Westphal-Edinger nucleus. Depending upon the autonomic balance of the individual, the light reflex may be depressed, enhanced, or unchanged:

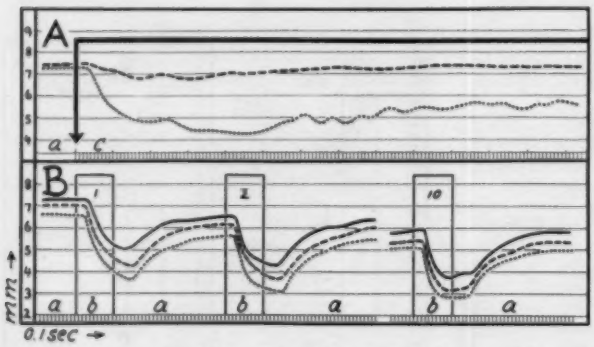

Fig. 10 (Lowenstein and Loewenfeld). Effect of dim illumination of the contralateral eye upon pupillary reflexes to bright light: Subject A.

A, first line. At *a*, both of the subject's eyes had been adapted to darkness for 30 minutes. During the time framed by the arrow *c*, the *left* eye was adapted to a very dim (broken line) or to a slightly brighter (dotted line) diffuse, steady light (eyepatch lamp, cf. Methods, 3).

B, second line. The solid line represents the pupillary reactions of the subject's *right* eye after dark adaptation of both eyes, the broken line those after adaptation of the *left* eye to the dimmer light used in A, and the dotted line those after adaptation to the brighter contralateral light used in A. During the one-second intervals *b*, the subject's *right* eye was exposed to light flashes of 1/100 of "standard" intensity.

Contralateral adaptation to dim, diffuse light enhanced the pupillary light reflexes in the same way as the homolateral or bilateral adapting light used in the experiments of Figures 8-A and 9. The enhancing effect was slightly more pronounced when the brighter than when the dimmer adapting light was used.

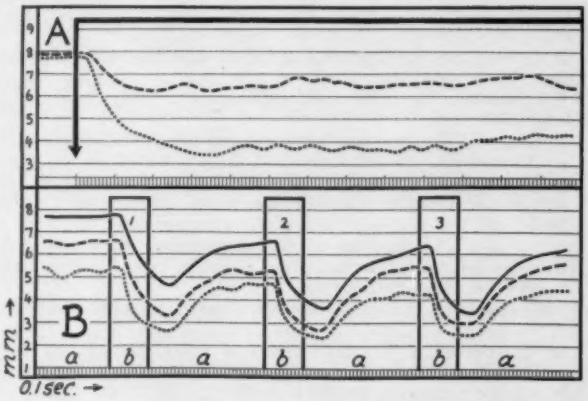

Fig. 11 (Lowenstein and Loewenfeld). Effect of dim illumination of the contralateral eye upon the pupillary reflexes to light: Subject D.

The same experimental conditions were used as in Figure 10. Subject D was a 24-year-old woman. She was calm and more fatigable than Subject B but less so than Subject C.

A, first line. The pupillary effect of dim illumination was more pronounced than in the tense Subject A (cf. fig. 10).

B, second line. Very dim illumination of the contralateral eye (broken line) enhanced the light reflex, while the brighter illumination (dotted line) suppressed it.

The effect of repeated elicitation of the light reflex was similar to that of dim illumination: the third pupillary reaction in darkness (solid line) was similar to the first with dim contralateral light (broken line), while the third reaction with dim light resembled the first one with brighter contralateral illumination (dotted line).

a. When the subject is calm and well rested, adaptation to dim background illumination causes the pupil to become slightly smaller than in darkness, while light reflexes, elicited by standardized bright light flashes, are unchanged or slightly diminished.

b. When the subject is tired, the same background illumination has a profoundly depressing effect; the pupil becomes quite small, and the reactions to standard light flashes become inextensive and pathologic in shape.

c. When the subject is emotionally excited, or under the influence of psychosensory stimulation, the pupils are large in darkness and remain large after adaptation to dim background illumination. In such subjects, reflexes elicited by standard intensity light flashes are more extensive after adaptation to dim light than after adaptation to darkness.

The experiments again point out the fact that the pupillary light reflex does not depend upon the activity of an isolated reflex arc, unaffected by central nervous events, but is a complex function. Retinal sensitivity, afferent and efferent conduction as well as central nuclear and supranuclear mechanisms affect extent and shape of the movement.

In physiologic experiments on the pupil it is necessary to consider the central nervous effect which is brought about by adaptation to dim light. Since even very weak background illumination may alter extent and shape of the pupillary reflexes profoundly, with opposite changes in different subjects, great care should be taken not only to control the shape, size, intensity and duration of the stimulating light but also to standardize the light used for observation or recording of pupillary activity, and to give adequate information about this illumination.

In clinical work, the comparison of pupillary light reflexes elicited in darkness and in the presence of a standard intensity of background illumination has proven to be a valuable diagnostic test because functional or low-grade diencephalic impairment may be made manifest.

635 West 165th Street (32).

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PLEOPTICS

A survey of its origin and present European use, with comments on Bangerter vs. Cüppers and suggestions for American ophthalmologists

Henry L. Birge, M.D.
Hartford, Connecticut

Pleoptics, or the technique of restoring vision to amblyopic eyes, received some attention in this country in 1958 and 1959. Reports that, with this method the vision of older children, up to 20 years of age, could be satisfactorily improved gave the impetus to a rapid European tour, where definite answers to some of the questions might be obtained.

Visits to ophthalmologists in Geneva, Zurich, St. Gall, Berne, Paris and London were fruitful in providing the following information, which may be helpful to American ophthalmologists considering pleoptics, and especially regarding the controversy between Bangerter and Cüppers.

The questions to be settled included basic ones:

1. How much is a child treated?

2. What results are being obtained in six European clinics?

3. Is in-patient treatment required, and if so for how long?

4. Does the pleoptic school include usual curricula of public school for the proper grade?

5. Where does the dividing line between pleoptics and orthoptics exist?

6. Is pleoptics desirable for our patients?

I will begin by saying that peoptics is definitely desirable for those of our patients who do not respond by the age of five years to our present therapy for amblyopia, namely, refractive correction and occlusion of the good eye, with operation for the residual strabismus. It should be emphasized that cycloplegic refraction, yearly, with careful retinoscopy will still cure refractive amblyopia more certainly than pleoptics without careful refraction.

In those patients who come to us with well-developed amblyopia and who are in

school or cannot for other reasons practice efficient occlusion of the good eye, pleoptics can logically be expected to offer improvement, provided well-organized pleoptic training is developed—a pleoptic school is the ideal arrangement—for cases of well-established amblyopia.

Choice of pleoptic technique will depend on an understanding of Bangerter's methods compared to Cüppers, and will be led by time, cost, and in-patient vs. out-patient care.

Prof. Dr. A. Bangerter is Chefartz at St. Gallen Kantonspital, Switzerland. He is a youngish middle-aged man, a perfectionist and a migraine sufferer. His Pleoptophor developed, with the aid of suggestions by Prof. Goldmann of Berne, and others, through many phases since 1947, is now more like a Nordensen fundus camera than an ophthalmoscope.

He does not speak English well but is publishing a textbook for release soon, according to Dr. Graemiger, who showed us around the Pleoptic School in St. Gallen.

Dr. Bangerter's clinic is large and active, under the supervision of a chief technician, and his resident staff. He trains nine or more pleoptic technicians, certified after two years. His new Pleoptic School of several stories is under construction adjacent to his old clinic. I noted children from Rhode Island and California in his Pleoptic School. Records noted at random showed several children who had improved from 20/400 to 20/40 in two and one-half weeks. They keep excellent records.

The children who are his patients are hospitalized for three weeks, during which time basic training is given morning and afternoon. This is passive treatment as opposed to orthoptics or Cüppers method.

After a complete atropine examination and glasses, the Pleoptophor is used twice daily until the amblyopia and eccentric fixation are overcome. Then the child may go on to the main training, required by two thirds of all his cases. The amblyopic eye is dilated and kept covered when not in training. As it improves, graduated occlusion of the good eye is practiced. Binocular training, orthoptics, follows on an out-patient basis. There is even an "orphan's" home for children whose parents cannot remain with them for the out-patient phase.

Bangerter's children are very happy, due chiefly to his fine technicians. Every aid is given to the amblyopic eye, so that it may move from the Pleoptophor to the synoptophore rapidly. Bangerter's intermediate instruments appear numerous but actually are no more so than in Cüppers method, or in many orthoptic clinics. It requires great patience to train a young eye in such a vigorous course. Some of his instruments can be dispensed with, although a variety of teaching aids is a benefit. Bangerter's subsidiary instruments are: the localizer, Mnemoscope, the Centrophor, and projection devices for training and copying, one of which has a buzzer that sounds when the child goes off the copy-line. Repetition and constant movement to more difficult visual tasks are the daily routine.

There seems to be general agreement among those who have studied pleoptics that daily treatment is important: twice a day in the early stages and once a day after progress has been obtained. The therapists or technicians are also of greatest importance. They must be trained to know the macula and to keep it under observation during treatment. This is the difficult thing for orthoptic technicians to do and many of them feel they cannot do justice to the child with their present knowledge.

Since frequent treatment is required and technicians are necessary for the treatment of any great number of patients, the instruments used must be suitable for technicians. Bangerter's instruments are easily used by technicians, while there is more difficulty for the technician with the Cüppers Euthyscope and Haidinger brush or co-ordinator. It is also apparent that children like games and that Bangerter's instruments may be more fun for the youngsters than just looking for

an after-image and then at the co-ordinator. Therefore, whichever method is used, the training aids of Bangerter would be helpful as intermediate instruments.

Bangerter's Pleoptophor is a large fully controllable device for keeping the fovea of the amblyopic eye under visual observation, while (1) dazzling out the eccentric fixation, and then (2) stimulating the fovea. It is binocular, controlling the amblyopic eye, through control of the good eye, and begins as a passive form of treatment. The fovea is protected by a central covering point of appropriate and variable size and the push-button change from the initial examining light intensity to the dazzling intensity is most important until an active phase of cooperation is achieved. Light intensity is varied with the size of the central scotoma and its penetrability. Colored filters are available. In the active phase of training Bangerter uses other senses—hearing, touch, and memory—to aid the amblyopic eye.

Bangerter's training is not only ocular but also directed at restoring normal cortical responses. Amblyopia is primarily a cortical disturbance and its correction, while aimed primarily at the fovea, carries through to re-educate the cortex.

Cüppers has a similar aim, although he states it differently. He aims to restore normal spatial projection by the retina. He may be getting into problems of aniseikonia before he has restored sufficient visual acuity to correct aniseikonia. Both Cüppers and Bangerter occlude the amblyopic eye until foveal fixation is relatively constant.

Stimulation of the fovea on the Pleoptophor is done not only by developing a consciousness in the patient of the foveal area—or after-image—but is also done by controlled light aimed directly at the fovea, which is under observation and control. It is at this point that passive treatment becomes active recognition of the foveal light stimulus and from this point that subsidiary instruments are used. With the Pleoptophor a good technician can "hit" the fovea with controlled light stimuli 50 to 100 times in rapid succession. This is one of the chief differences between the Bangerter and Cüppers methods, as will be seen later.

The cost of the Bangerter equipment, as well as the Cüppers, is listed in table form for comparison.*

BANGERTER	
Pleoptophor	$2950.00
Localizer	$ 125.00
Centrophore	$ 275.00
Separator	$ 150.00
Maddox Cross	$ 50.00
Acoustic Localizer	
Mnemoscope	
Contrasting Mnemoscope	
Copy Mnemoscope	
Synoptophore	
CÜPPERS	
Visuoscope	$ 119.00
Euthyscope	$ 165.00
Flasher	$ 150.00
Coordinator	$ 165.00
Synoptophore	$1250.00

Prof. C. Cüppers has recently devised the Visuoscope and Euthyscope to perform a system of pleoptic training. Cüppers (it is reported) has recently been appointed professor at Giessen, Germany (within six months). It was impossible to contact him during my trip, through the usual channels of government or travel agencies, telephone, mail, post office, and so forth, which is unusual in Germany and Switzerland. It is agreed that his instruments have originated after Bangerter. They are in use in several clinics. His lecture tour of the United States in January, 1960, was cancelled due to illness but soon will be rescheduled. An excellent report on Cüppers methods in pleoptics by Priestley, Byron, and Weseley appeared in THE JOURNAL 48:490-502, 1959). Cüppers also uses both in-patient and out-patient therapy and trains technicians in the use of

* Prices, as of January, 1960, quoted by:

1. Alfred Poll, 40 West 55th Street, New York 19, New York.
2. Th. Haggenmacher, Alstetterstrasse 155, Zurich 48.
3. Omega Instrument Company, 40 West 55th Street, New York, New York.

the Visuoscope, Euthyscope, and so forth, as well as his synoptophore.

In the Cüppers method of pleoptics the initial cost of the Visuoscope and Euthyscope are moderate. These instruments also have other uses besides pleoptics. In this method of pleoptics the eccentric fixation of the amblyopic eye is first accurately measured and charted with the Visuoscope. This is a subjective function by the patient. In cooperative patients it is satisfactory. As Priestley, et al., point out, it is much better than the corneal reflex for determining eccentric fixation.

After diagnosis of eccentric fixation, the Euthyscope is used to produce an after-image (positive) over the fovea. There are two sizes of discs for covering the fovea—three and five degrees. This is changed to a negative after-image through the use of the "flasher," which changes a room from dark to light, automatically, but slowly and with no control of the intensity of the light.

However, due to the difficulty of observing a child's eye with the Euthyscope—or ophthalmoscope—and having no sure control over the position of the amblyopic eye, the foveal image of the dark spot in the Euthyscope may be misplaced. Parafoveal or paramacular fixation cannot be well controlled and a course of treatment may be undertaken which does not stimulate the fovea itself. In this initial stage the program is not passive either; the child has to understand what is wanted and help. As Cüppers and Priestley, et al., state, monocular diplopia results in some cases. In the Bangerter method this is controlled by controlling the good eye, by an excellent view of the amblyopic eye, and by hard work—daily.

The Cüppers phenomenon of using the positive and negative after-image appeals to physiologists. It is a magnificent demonstration of physiologic function used in therapy. However, it seems to me that it is not as accurately controlled as Bangerter's method, which also may use the after-image, nor is it possible to stimulate a refractory fovea accurately by means of the after-image alone.

It seems to me, in the absence of reports comparing results of each method, that the Cüppers method (Euthyscope) would be successful in less difficult cases. We know also that, while the Haidinger brushes are supposed to be visible only at the macula, some cases show relatively good spatial values in the absence of foveal fixation. Fixation disparity, or binocular single vision in the absence of bifoveal fixation, is not easily diagnosed, even with the Visuoscope.

Almost all other methods of physiotherapy begin as passive therapy and progress into active. Objective forms of therapy usually coincide with the philosophy of repetition and hard work.

In the Cüppers method, which is popular in Zurich and Geneva, the treatments are given only a few days in the week, generally, and as no in-patients are taken, twice-a-day basic training is used. To be sure, many of the cities in Switzerland are small enough for the children to get to the clinic easily but it requires a large staff of well-trained technicians to handle a number of cases twice a day, even for three weeks.

After the Euthyscope, Cüppers goes to the Coordinator. This instrument relies upon the Haidinger brush phenomenon, which can only be seen by the macula according to most physiologists. Here again Priestley, et al., illustrate a patient who is seeing the brushes with a false macula (parafoveal?).

The Coordinator, or the Haidinger brush phenomenon, is difficult for many people to see. Haidinger brushes have been demonstrated at the American Academy of Ophthalmology and Otolaryngology and many will recall this fact. Difficulties, even with relatively normal vision, will be proportionately greater in children and in amblyopes. The Haidinger brush phenomenon may require at least 20/30 vision for its appreciation. I was unable to find any cases of amblyopia treated by the Cüppers method in which rapid improvement of such magnitude as with Bangerter, had occurred (from 20/

400 to 20/30). Records were uniformly excellent in all clinics.

In London, where the utmost co-operation was received from Drs. Sorsby, Lyle, Stallard, Ridley, Law, and others, pleoptics is still on an experimental basis in the Orthoptic Department of Moorfields, Westminster Branch. In Paris, Dr. Bailliart was most helpful but I did not see Dr. Sevrin. Pleoptics was not in active use as far as I could determine. In Geneva, Dr. Franceschetti was tremendously hospitable and helpful and his very active clinic does a little pleoptics, after Cüppers.

Dr. Amsler of Zurich has three technicians who follow the Cüppers' technique and he offers a course of training in pleoptics for technicians.

Dr. Goldmann of Berne does pleoptics after Bangerter and Cüppers and, while there are no in-patients, his clinic does carry out treatment twice a day. This is possible because there are two sessions of school, each morning and afternoon, and the child can go to the clinic either before or after each session of school. This clinic feels that the cost of in-patient care is prohibitive. There appears to be many excellent technicians, some of whom had studied with Cüppers. They also were unable to get published or other final reports on Cüppers' results.

In all clinics, after normal correspondence is established, the patient moves to the Synoptophore and orthoptics. Cüppers and Amsler use the Cüppers' Synoptophore, which is reported as not yet being adapted to our American current. Elsewhere the major Synoptophore is used to develop binocular fixation, as follows:

a. The after-image is stimulated in each eye, one vertical and one horizontal.

b. When the cross appears, an animal is inserted into one slide carrier and is superimposed on the cross.

c. A cage is superimposed in the other slide carrier, and the animal should be in it.

d. Fusion is then developed.

Summary

If properly used, pleoptics offers potential benefit to any patient with amblyopia who is more than six years of age.

Most ophthalmologists will not have the time to devote to it and therefore specially trained technicians are required. Close cooperation between the physician and the technicians is necessary. A course of training for technicians is needed. One technician could take care of four cases daily in the beginning. In-patient or twice-a-day therapy is helpful for the first few weeks of treatment. Bangerter's technique appears to me to be the one to follow but, even if Cüppers' instruments are used, the Bangerter secondary instruments will benefit the child. When the Synoptophore can be used, the case can be transferred to an orthoptic clinic.

Much remains to be learned and studied about pleoptics, and the weaknesses in this survey will be apparent as pleoptics are put to use.

664 Farmington Avenue (5).

Ophthalmic Miniature

When I was clinical assistant at Moorfields, I used to observe that some patients waiting their turn were obviously squinting, but when they came to speak to me their eyes were apparently parallel.

J. H. Jackson, "Defects of sight in diseases of the nervous system," *Royal London Ophth. Hosp. Reports*, **5**:289, 1866.

DECOMPRESSION OF THE OPTIC CANAL BY THE TRANSETHMOIDAL ROUTE

SHOJI NIHO,* M.D., KAZUHIDE YASUDA,* M.D., TIKASI SATO,† M.D., SINICHIRO SUGITA,† M.D., KENICHI MURAYAMA,† M.D., AND NORISIGE OGINO,† M.D.
Yokohama, Japan

Until the present time, the decompression of the fractured optic canal has been made only through the transfrontal route. However, this approach permits only the unroofing of the optic canal and removing the incidental hematoma; it fails to excise its mesial wall.

We present here our experiences in seven cases of damage to the optic nerve resulting from basal fractures. These were successfully treated by this new method. This technique consists of uncapping the roof of the optic canal and removing its mesial wall by the transethmoidal route. It affords additional room for expansion of the traumatized nerve.

OPERATIVE PROCEDURE

The operation is performed under local anesthesia. We consider this to be of the utmost importance, since this procedure primarily depends upon the subjective response during the operation for the restoration of the patient's vision. As the first step, the mucosal lining of the antrum, ethmoid, and sphenoid sinuses is completely removed through the transantral route. Next, extranasally, the lining of the frontal sinus is also removed. This is extremely important to prevent postoperative sinal and intracranial infection. We then proceed to remove the medial wall of the orbit as far back as the beginning of the bony optic canal. A lateral traction on the orbital content is applied to expose the canal (fig. 1-B). Care must be taken to avoid injury to the trochlea and lacrimal sac. The operation is continued to remove the mesial wall of the optic canal until the outer end of the anterior wall of the chiasm is reached (fig. 1-C). Undue pressure on the nerve must not be applied at this stage. The posterior limit of the canal is recognized when the anterior wall of the chiasm appears in line with the frontal plane. We call this the Grade I operation in the opening of the optic canal.

Having used local anesthesia, if there is no subjective improvement in vision, we now begin to unroof the optic canal. This is our Grade II operation (fig. 1-D). A fresh surgical set up is now made. A craniotomy is performed through the posterior wall of the frontal sinus. A window, 1.5 by 2.0 cm. in size, is made. The dura is elevated, care being taken not to traumatize the lamina cribrosa. The anterior wall of the sulcus nervi optici is exposed by inserting Niho's brain elevator. The roof of the ethmoid air cavity and of the optic canal is removed by chisel and curette. Sometimes, the processus alae parvae is sacrificed. General anesthesia is contraindicated, since one cannot determine which one of these two procedures must be employed in a given case.

After the operation is completed, a polyethylene tube is inserted from the nasal cavity into the frontal sinus; the antrum and ethmoid sinuses are filled with gauze tampons. The field of operation is filled with antibiotic solution. The wound is closed by the usual method and sterile dressings are applied.

During these operations when the decompression of the optic nerve is successful, these patients invariably indicate in no uncertain manner the recovery of their vision. Complete visual restoration occurs in three to six months after surgery. In Cases 1, 5, 6, and 7, after decompression of the optic

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* Rhinologists.
† Ophthalmologists.

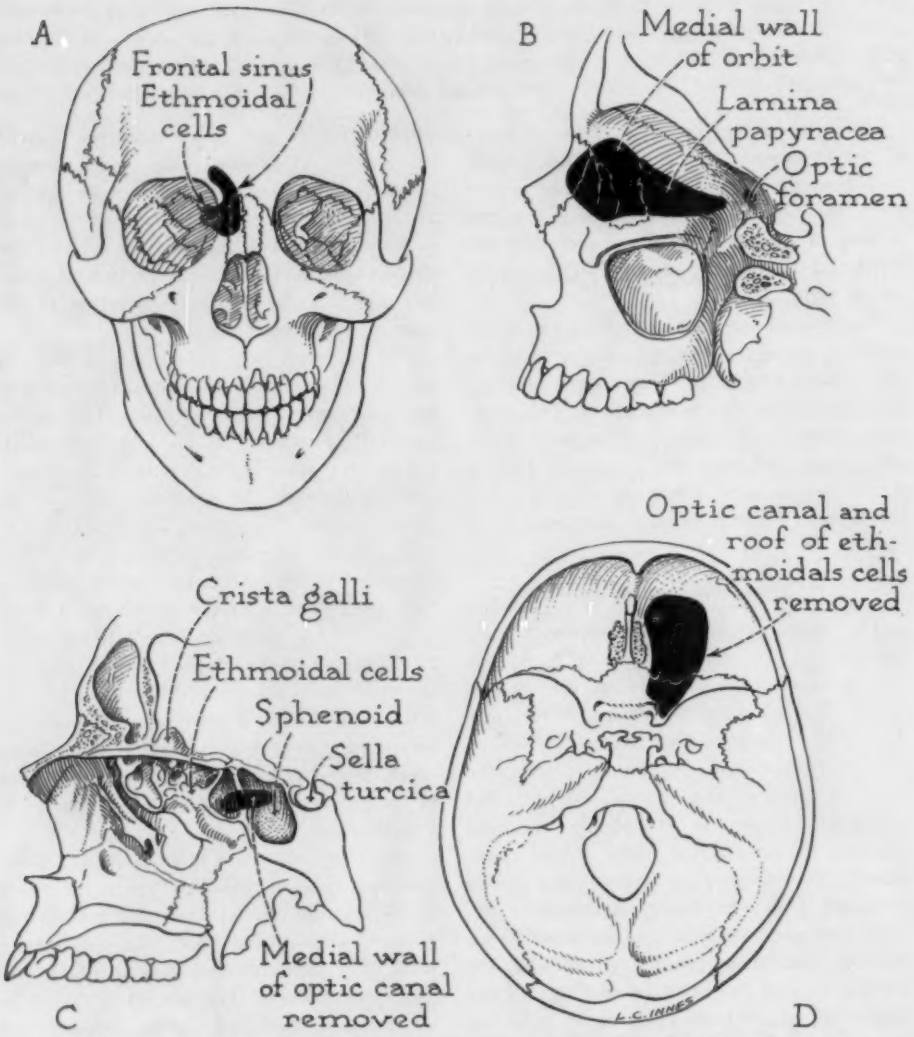

Fig. 1 (Niho, et al.). (A) Removal of shaded portion to enter the ethmoidal cells and the frontal sinus. (B) Removal of the medial wall of the orbit to the distal end of the bony optic canal. (C) Removal of the medial wall of the optic canal. Shaded portion, Grade I operation. (D) Craniotomy. Removal of the roof of the ethmoid cells and of the optic canal. Shaded portion, Grade II operation.

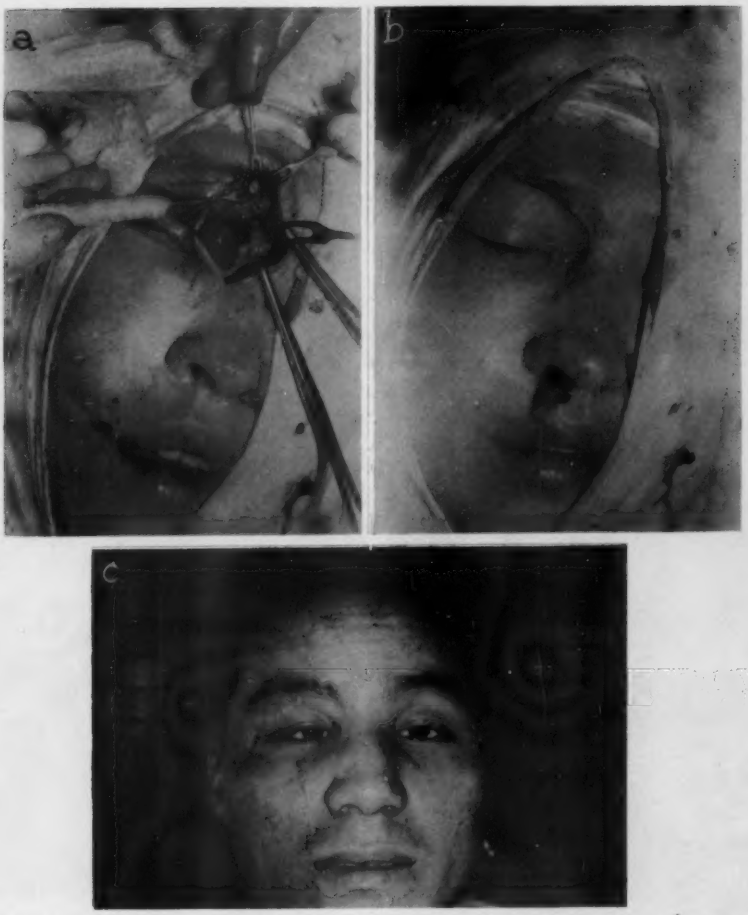

Fig. 2 (Niho, et al.). (a) A small window is made at the anterior wall of the frontal sinus. (b) The wound is closed with nylon suture. (c) *Case 1,* four months after surgery.

TABLE 1

REPORT OF CASES

Case	Age (yr.)	Sex	Days After Injury Until Operation	Operation	Preoperative Vision	Postoperative Vision
1	19	M	37	Grade II	0	Light Perception
2	25	M	6	Grade II	F at 1.5–2.0 m.	6/15
3	30	M	52	Grade I	F at 0.5 m.	6/30
4	38	M	263	Grade I	6/60	6/10–6/8.6
5	31	M	14	Grade II	F at 1.0 m.	6/15
6	34	M	6	Grade II	F at 1.0 m.	6/60
7	9	F	5	Grade II	0	F at 2.0 m.

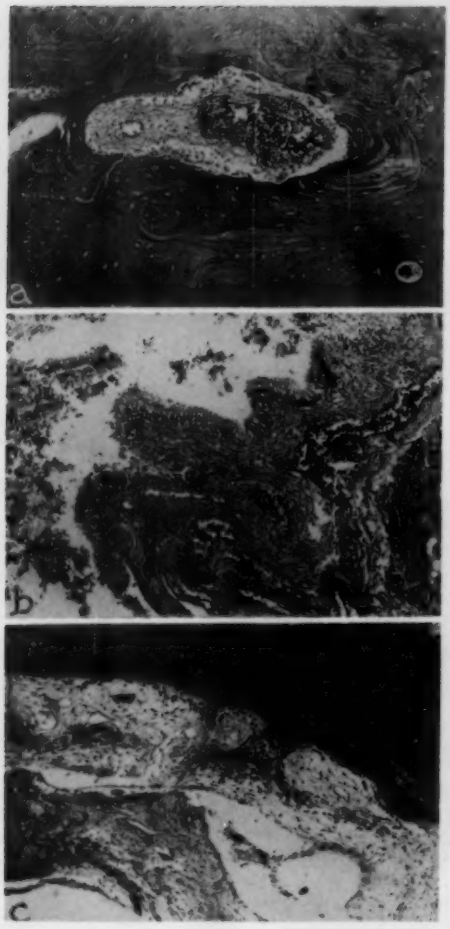

Fig. 3 (Niho, et al.). (a) *Case 1.* Anterior wall of the ethmoidal cells. Note disappearance of bone nuclei, indistinct bone lamella, abnormal bone lamella, widened Haver's canal with proliferated connective tissue, filling of red blood cells in widened blood vessels, and lacunar resorption inside of the canal. (b) *Case 1.* Mucous membrane of the frontal sinus. Severe sinusitis frontalis and much exudate in the sinus caused by traumatic obliteration of nasofrontal duct. (c) *Case 1.* Roof of the optic canal. On the cranial side, osteoblasts, bone degeneration, bone regeneration, osteoid tissue, and so forth are seen (37 days after injury).

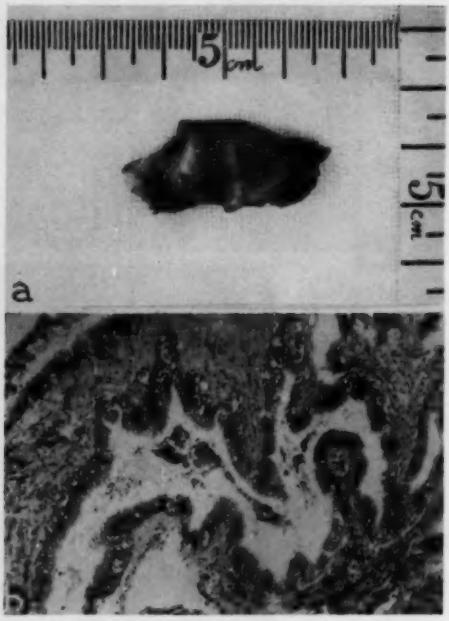

Fig. 4 (Niho, et al.). (a) Large bone fragment is removed from the roof of the ethmoidal cells and orbit (1.5 by 3.5 cm.). (b) *Case 2.* Mucous membrane of the frontal sinus. Sinusitis frontalis of a mild grade and exudate were observed.

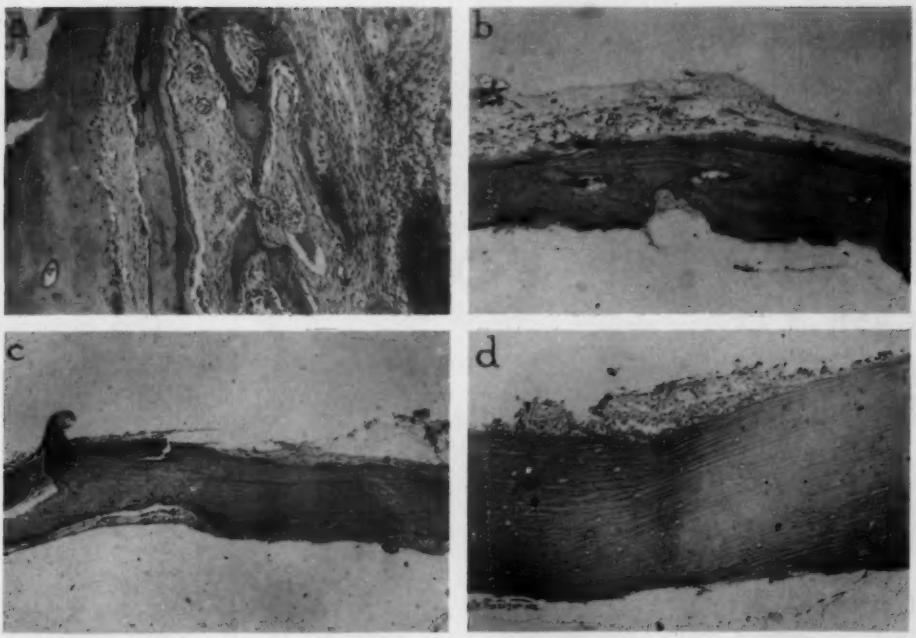

Fig. 5 (Niho, et al.). *Case 5.* Bone fragment from medial wall of orbit. Entensive changes in the bone tissue. Resorption of carious bone tissue, bone regeneration, thickening of periosteal layer, osteoid tissue, and so forth are seen (15 days after injury). (b) *Case 5.* Medial wall of the optic canal. Pyknosis of bone nuclei. Disappearance of bone lamella. On the sinus side (above), thickening of periosteal layer, regeneration of bone tissue, osteoid tissue and, inside of optic canal, lacunar resorption are seen. (c) *Case 6.* Medial wall of the optic canal (six days after injury). Slight changes in the bone tissue. (d) *Case 7.* Roof of the optic canal (five days after injury). On the cranial side, bone regeneration and disappearance of bone nuclei are seen.

TABLE 2

REPORT ON BONE FRACTURES FOUND

Case	Septum	Maxilla	Os Lacrimale	Ethmoid	Medial Wall of Orbit	Anterior Cranial Fossa
1				*	*	
2		*		*	*	
3						
4						
5		*	*	*	*	*
6	*		*	*		*
7		*			*	*

* Bone fracture.

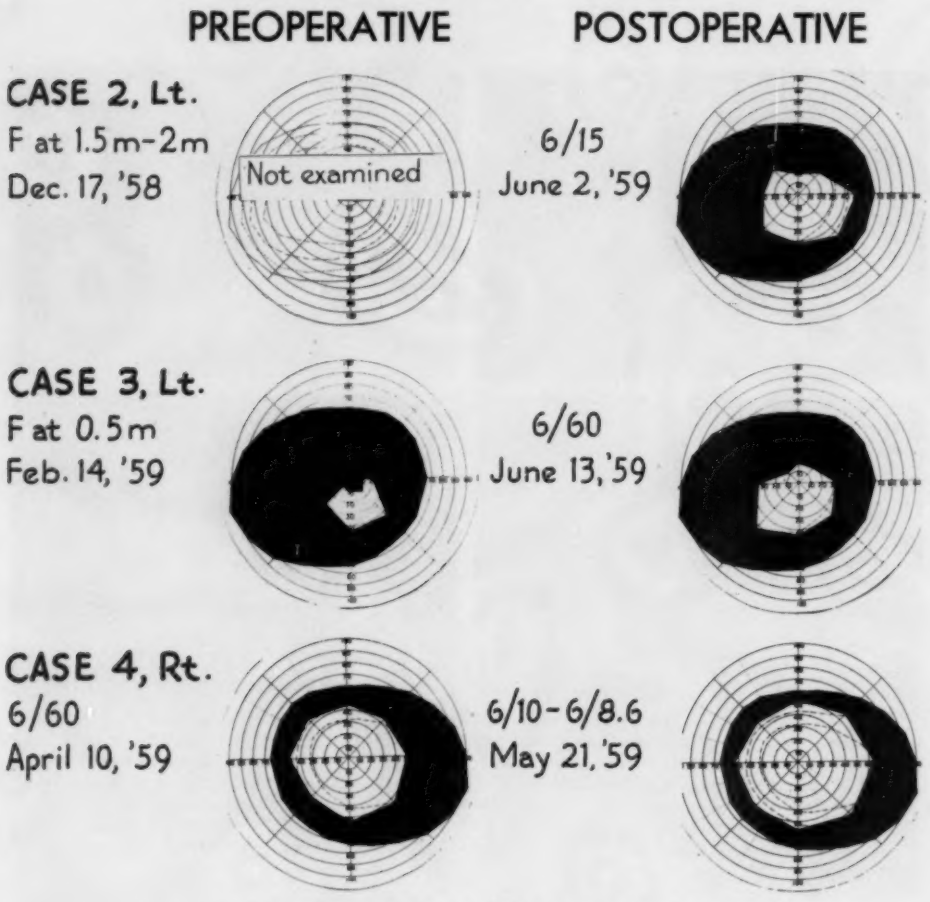

Fig. 6 (Niho, et al.). Visual fields in Cases 2, 3 and 4.

nerve, an abnormal pupillary reaction appeared. After recovery of the vision and appearance of normal pupillary reaction, this abnormal pupillary reaction disappeared.

During the operation, intradural hemorrhage was found in Cases 1 and 6. In Cases 1, 5, 6, and 7, specimens were obtained during the operation from several parts; the optic canal especially was examined histopathologically. Because a majority of the Japanese have histopathologic sinusitis accessoria chronica, we found various types of histopathologic changes in their sinuses. In addition to sinusitis, we found hemorrhage, thickening of periosteal layer, degeneration or regeneration of bone tissue, osteoid tissue, lacunar resorption, and so forth. But in many histopathologic specimens, we could not exactly distinguish whether the changes were caused by injury or were due to sinusitis.

Summary

1. Decompression of the optic canal was performed in seven cases by the extranasal transethmoidal route to the seriously damaged optic nerve caused by head injury.

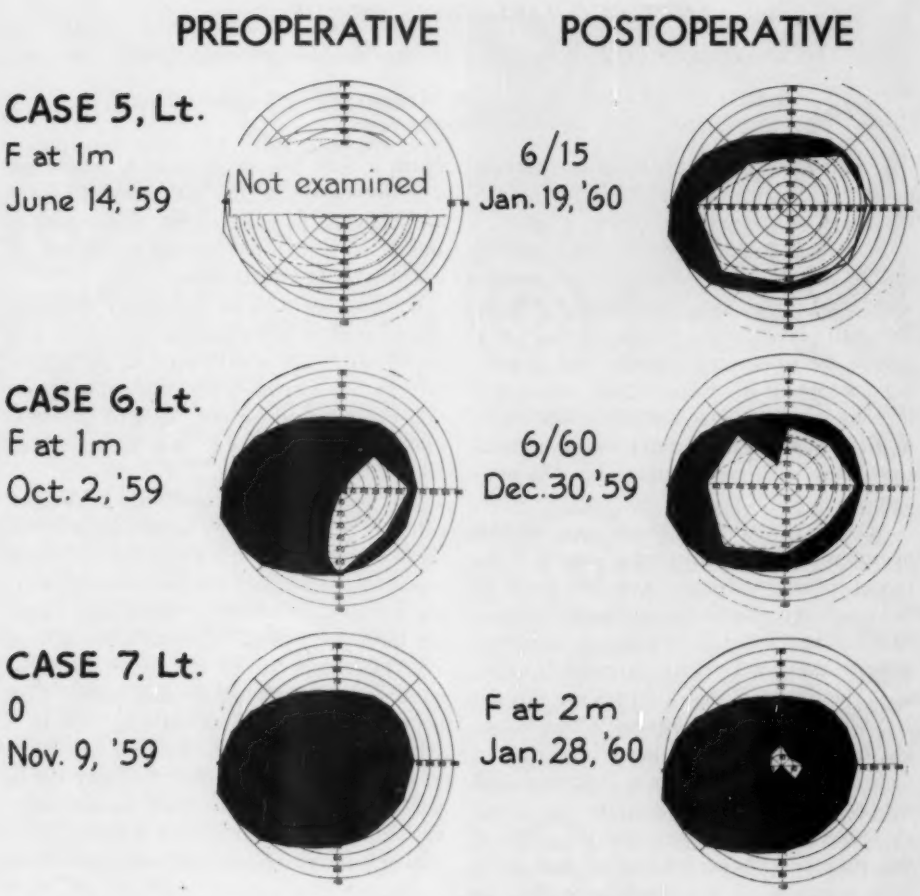

Fig. 7 (Niho, et al.). Visual fields in Cases 5, 6 and 7.

Visual recovery was obtained in every case.

2. The transfrontal approach now in vogue fails to remove the medial wall of the optic canal.

3. Removal of the medial wall of the optic canal is named a Grade I operation, and a combination of the removal of the medial wall and uncapping the roof of the canal a Grade II operation.

2 Daimachi, Kanagawa-ku.

ANATOMIC VARIATIONS OF THE IRIS*

In relation to basal iridectomy in the treatment of glaucoma

Robert N. Lehman, M.D., and Murray F. McCaslin, M.D.
Pittsburgh, Pennsylvania

Over 100 years ago Albrecht von Graefe described his operation of iridectomy for the treatment of glaucoma.[1] Today, a century later, this same operation with minor modifications continues to be used in selected cases with marked success. Duke-Elder[2] credits Bowman (1862) with a modification in which part of the iridectomy is performed by tearing a section of iris from its base, where it is inserted into the ciliary body. It is this modification only, usually referred to as a basal iridectomy, with which this paper is concerned.

According to Berens[3] the purpose of this operation of basal iridectomy is to tear the iris at its root and thus reopen the canal of Schlemm and expose the space of Fontana. Stallard[4] states that "The principle of iridectomy in the treatment of glaucoma is to reopen the filtration angle. To achieve this the incision must pass through the filtration angle, the iris must be torn away from its root over a fairly wide area, six to eight mm., and no peripheral remnants must be left to occlude the angle. It is likely that the width of the iridectomy (provided that it is not under four mm.) is of less importance than its extension to the root of the iris."

It is generally agreed that basal iridectomy is of value in the treatment of narrow angle glaucoma. Briefly, the essential steps in performing the procedure are as follows: The iris is grasped with a smooth iris forceps near its pupillary margin through a section into the anterior chamber placed parallel and a little behind the limbus. One pillar of a surgical coloboma is formed by a cut through the iris with the point of the scissors directed backward toward the root of the iris. Traction is then applied to the prolapsed iris which is torn free at its root. A second cut with the scissors similar to the first completes the coloboma by creating the opposite pillar and at the same time freeing the section of iris torn by the iridodialysis.

Unfortunately basal iridectomy does not always control the glaucoma for which it is performed. This is evidenced in the laboratory by the specimens on which this operation had been performed. This of course is to be expected and the reasons are many and frequently obvious.

One of the reasons for failure is thought, often, to be due to faulty technique, in which the iris is not torn at its base but is torn at a point some distance toward the pupil, leaving a stub a millimeter or more long covering the trabeculae. This forms a broad, firm synechia which closes off the drainage of aqueous and thus aggravates rather than helps the original condition (fig. 1). It is felt, however, that some failures attributed to the faulty technique described may not be due to the technique so much as to normal variations in the structure of the iris. These variations could encourage surgical dialysis

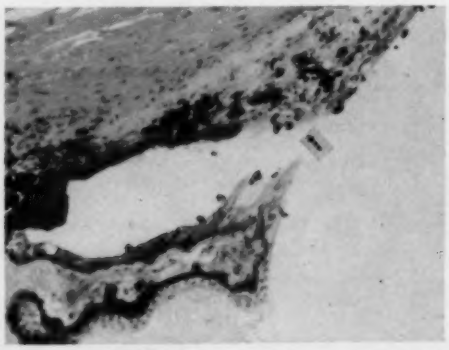

Fig. 1 (Lehman and McCaslin). Surgical coloboma in which stub of iris (arrow) remains to cover trabeculae of anterior chamber angle. Below arrow is a ciliary process.

* From the Veterans Administration Hospital and the University of Pittsburgh School of Medicine.

to occur at a point not at the iris base but at a point a little more proximal.

Anatomic variations in the iris

1. Incomplete dilator muscle of the iris

The fibers of this muscle may fail to reach the base of the iris and its insertion into the ciliary body (fig. 2). Normally these muscle fibers, lying between the pigment epithelium and the loose stroma of the iris, form what appears to be a relatively strong and continuous band (fig. 3). Duke-Elder[2] states that "At the ciliary margin the dilator thickens considerably and sends off prolongations composed sometimes of single muscle-cells, sometimes of groups of cells, with an accompanying connective tissue sheath resembling a tendon, which runs obliquely into the ciliary muscle and into the pectinate ligament, thus providing a fixed attachment."

It would seem that the dilator muscle supplies a large part of the strength to the iris in contrast to the delicate and friable stroma on one side and a single layer of epithelium on the other. If a section of this muscle were absent in the iris periphery, the iris would not necessarily tear at its base when tension is applied to it in performing a basal iridectomy, but would probably tear at a more proximal point, leaving the tab of iris to cover the trabeculae.

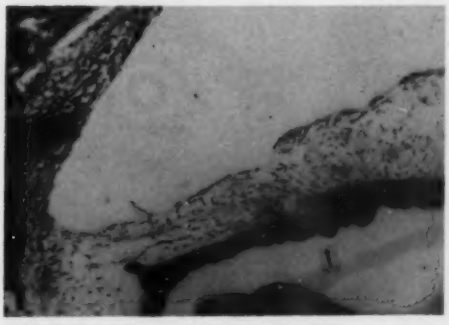

Fig. 2 (Lehman and McCaslin). Incomplete dilator muscle of iris. Arrow indicates end of muscle.

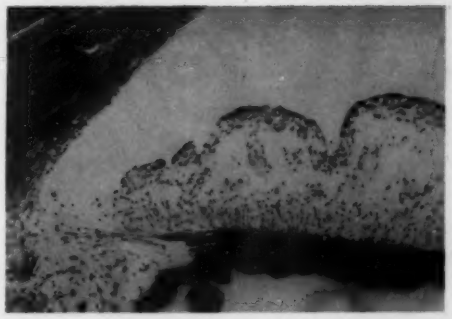

Fig. 3 (Lehman and McCaslin). Normal dilator muscle of iris.

2. Marked thinness of the iris stroma over a large area proximal to its base (fig. 4)

This thinning corresponds to the location of ciliary crypts in the iris. However, ciliary crypts in the marginal area are usually small and narrow and not nearly so large as what is being considered here. In the majority of eye slides examined in the laboratory, ciliary crypts are small or absent and the iris is relatively uniform in its thickness at the periphery (fig. 5). Thinness of the iris extending over a long area of its periphery does occur in a percentage of eyes, and, it is felt that if the dilator and iris root are firmly attached to its base, an attempt to tear the iris from its base could result in the tear occurring proximal to the iris periphery. This would leave an iris tab to cover the trabeculae and canal of Schlemm.

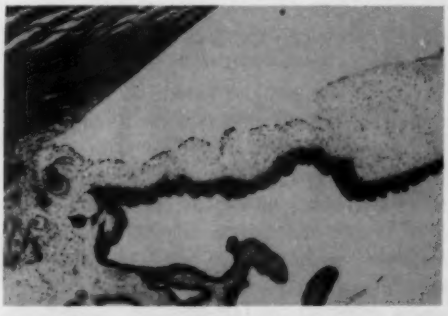

Fig. 4 (Lehman and McCaslin). Thinness of iris stroma proximal to its base.

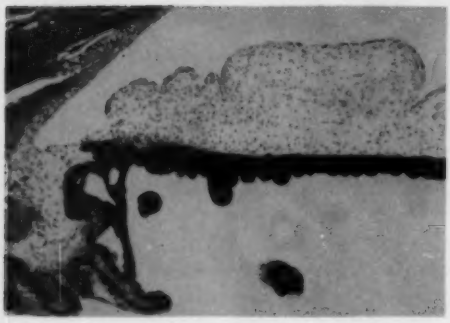

Fig. 5 (Lehman and McCaslin). Normal thickness of iris stroma near its base.

3. Combination of anatomic variations

A combination of anatomic variations found in Figures 1 and 2 shows a marked thinning of iris stroma in the region of a ciliary crypt and an absence of dilator muscle in the same area (fig. 6). This leaves a severely attenuated area which would most certainly tear in an attempted basal iridectomy at a point proximal to the iris base to leave a tab of iris to cover the trabeculae.

Significance

Narrow-angle glaucoma is less likely to occur in eyes with peripheral iris crypts.[6] However, glaucoma does occur in these eyes, as was seen in one section of an eye with narrow-angle glaucoma in which one angle was closed with a peripheral synechia and the opposite angle was open but there was a large crypt in the periphery of the iris of the open angle. It is believed that extremely large crypts may be less likely to prevent glaucoma than the relatively smaller ones.

The three anatomic variations could have important influence on the success or failure in basal iridectomy if attempted at the site of any of the variants. If this operation were attempted in any of these eyes in an area where the dilator muscle was absent in the peripheral iris, and especially if this absence were in the region of a large crypt, then the iris would most certainly be torn, not at its base, but at a more proximal point, leaving a tab of iris obstructing drainage and forming a synechia to aggravate the glaucomatous condition.

Research evaluation

The anatomic variations in iris structure were noted in the routine examination of eye slides in the pathology laboratory. To obtain further information concerning the relationship between these findings and glaucoma, all eyes on file at Pittsburgh Eye and Ear Hospital and Veterans Administration Hospital were surveyed and those removed for glaucoma that had had previous basal iridectomies were studied. It was hoped to find evidence as to whether the variants could be factors in the failure of basal iridectomies to work in these eyes. However, by the time enucleation had been done in these cases, the pathologic process within the globes had so altered the intraocular structures, particularly the iris, that no conclusions could be made, and this approach proved worthless.

Since working backward was of no value, it was decided to start from the opposite direction and study normal eyes to determine how frequently the variations may occur. Accordingly the files of eyes at the same hospitals were again reviewed and all normals and globes with normal angles were studied. There were naturally very few normal eyes except for donor eyes that had

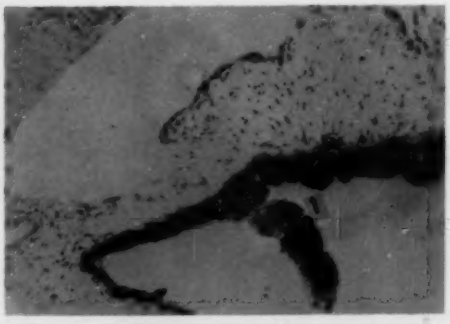

Fig. 6 (Lehman and McCaslin). Incomplete dilator muscle of iris in same area where iris stroma is relatively thin proximal to its base. Arrow points toward end of dilator muscle.

been used for corneal transplants. These were not very satisfactory as the irises were somewhat mutilated. The other eyes, removed for intraocular tumor, were interesting in that they showed that the anatomy described did occur fairly frequently. However, it was felt that this study revealed little other than that variations in anatomy do occur in the iris, but not much could be drawn as to frequency of occurrence. It was felt that a similar review of a series of normal eyes removed at autopsy would give a much better indication of how often these variations can be expected to be found ordinarily.

A series of this kind is rather rare, but Dr. William H. Havener, chairman, Department of Ophthalmology, Ohio State University, has established just such a collection. Permission was very graciously granted by Dr. Havener to study these slides and Dr. T. A. Makley in the Ophthalmic Pathology Laboratory provided a series of 99 consecutively numbered eyes, many of which were prepared in serial sections. Figures 2, 4, and 6 are from this collection. These slides were studied and the following findings noted:

1. Dilator muscle

a. There were five eyes in which the dilator muscle of the iris ended at a point so far from the iris base that if the iris were torn anywhere near this point the remaining segment of iris would completely cover the trabecular space in that area of the angle of the anterior chamber. Also, these irises certainly gave the impression that they would be most likely to tear in this region if tension were applied at the proximal end.

2. Thinness of iris periphery

a. There were five eyes in which there were very large peripheral iris crypts, which made the iris periphery quite narrow. If the iris were torn at the thinnest point in any one of these, the remaining tab would more than cover the entire trabecular area.

b. There were an additional 10 cases with peripheral iris crypts of the type described by Posner.[6]

3. Combinations

a. There were three cases which showed absence of the dilator muscle in the iris periphery, which area was also quite narrow because of the presence of a large crypt in the same region.

In two of these cases there were serial sections. These showed that the anatomic variations were not present in all sections, but were present in several areas of the iris in the same eye.

It is interesting to note that in two eyes in which artefacts occurred during the preparation of the specimens, the iris in each was torn, and they each tore at the peripheral end of the dilator muscle and at a considerable distance from the base of the iris.

Discussion

From the foregoing it is believed that approximately 10 percent of the eyes examined have one or both of the anatomic variations described in this paper. Further it is felt that if a basal iridectomy were attempted in these eyes in the region of the variations, that five to 10 percent of the operations could fail because the iris would tear at a point proximal to its base at the site of these variations. Just what percentage of eyes with narrow-angle glaucoma would possess the short dilator muscles and large iris crypts could not be determined. It would seem that the short dilator muscle would have no relationship to the occurrence of glaucoma and that one could expect it to be present in five percent of glaucomatous eyes.

How one could foresee clinically whether such a condition exists and in which arc of the iris circumference is impossible to tell. It was seen that narrow-angle glaucoma does occur in eyes with peripheral iris crypts. However, glaucoma is less likely to occur in these eyes, and this finding, especially in the presence of good dilator muscle, is probably of less importance.

Should a basal iridectomy be contemplated on an eye with peripheral iris crypts, it is felt that the surgical coloboma should not be attempted at the site of a crypt if seen by gonioscopy but at some other site on the chance that there may be an absence of the dilator muscle in the same region as the crypt. Also, since the angle is more likely to be open at the site of the crypt anyway, it would be better to leave this section open and attempt to open an additional section of the angle elsewhere.

SUMMARY

1. Three variations of the anatomy of the iris are described.

2. An explanation of how these variants could be the cause of failure in the operation of basal iridectomy is presented.

3. One or both of these anatomic variants was found in five to 10 percent of a consecutive series of eyes removed at autopsy.

University Drive (40).

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ASPERGILLOSIS OF ORBIT*

REPORT OF A CASE TREATED BY THE NEWER ANTIFUNGAL ANTIBIOTIC AGENTS

JOSEPH C. BAILEY, M.D., AND JOHN M. FULMER, M.D.
Little Rock, Arkansas

Though recognized more commonly in recent years, aspergillosis of the orbit continues to be a rare disease for which treatment has been quite unsatisfactory. There have been only five case reports of orbital aspergillosis. In all of these, the infection was apparently primary in one of the accessory nasal sinuses and secondarily invaded the orbit.

Wright,[1,2] 1927, reported two cases, one being due to Aspergillus oryzae, and the second to Aspergillus flavus. The first case was treated with X-rays and radium with early improvement but later progression of the disease. The second case was also treated with X-rays and then lost to follow-up so that the outcome was not known.

Adams,[3] 1933, reported a case due to Aspergillus fumigatus invading the orbit, antrum, ethmoid and sphenoid sinuses. The patient was treated by radically removing the granulomatous tissue from the sinuses and high doses of potassium iodide systematically with apparent cure after a one-year follow-up.

A fourth case was reported by Veirs,[4] 1958, in which the organism was thought to be an aspergillus, but the species was not identified. The patient was treated with large doses of penicillin and sulfadiazine with improvement. The patient was followed for two years.

The fifth case was reported by Tikomirov,[5] 1958. The patient died as a result of dissemination to the central nervous system and diagnosis was established at autopsy. Treatment is not known.

* From Division of Ophthalmology, Department of Surgery, Veterans Administration Hospital and University of Arkansas Medical Center.

In the past few years newer antifungal drugs have been developed for treating both local and systemic mycotic infections. Nystatin, amphotericin-B and griseofulvin are among the most successful of these drugs. They have been widely employed in treating mycotic infections including certain ocular conditions such as mycotic keratitis and corneal ulceration. More recently amphotericin B has been used to treat chorioretinitis due to histoplasmosis.[6] However, there have been no reports concerning their use in orbital infections.

Nystatin (Mycostatin, Fungicidin) a polyene antibiotic produced by Streptomyces noursei was described by Hazen and Brown,[7] 1950. It has been found to be highly active in inhibiting the growth of a wide variety of fungi but to have little or no effect on other types of micro-organisms. Its action is considered to be fungistatic rather than fungicidal. It inhibits both endogenous metabolic activity and utilization of various substrates by fungi, especially yeasts.[8] It has been found to be particularly effective in moniliasis which was accessible to topical therapy. It is poorly absorbed when given orally for systemic mycoses. Intravenous preparations are available but administration may result in chill and fevers. Intramuscular preparations are poorly tolerated due to local reaction. In spite of its broad spectrum of antifungal activity, its therapeutic effects in systemic mycoses have been disappointing due to the fact that toxicity prevents the administration of adequate quantities of the drug.

Fig. 1 (Bailey and Fulmer). Initial appearance of patient, February 10, 1959.

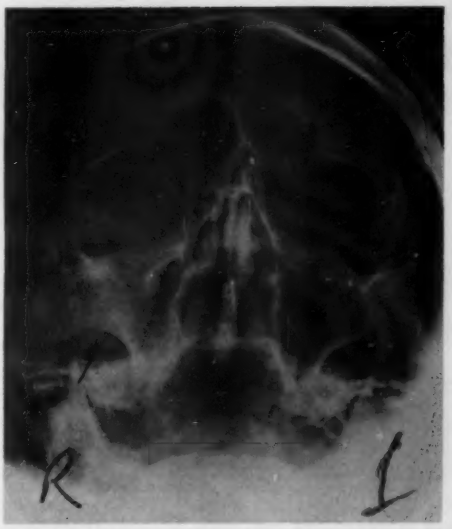

Fig. 2 (Bailey and Fulmer). X-ray view of sinuses, showing involvement of right antrum with bony destruction of floor of orbit.

Amphotericin-B is a new antifungal antibiotic which was isolated from an unidentified species of streptomyces, and described by Vandeputte[9] in 1955. It is the drug of choice in the deep mycoses and is highly effective against histoplasmosis, blastomycosis, coccidiomycosis, and cryptococcosis.[10,11] The drug can be given orally or intravenously; however, the intravenous route is preferred since absorption from the gastrointestinal tract is very poor. Optimal intravenous dose is thought to be from 0.7 to 1.4 mg. per kg. per day, given in 500 to 1,000 cc. of 5.0-percent glucose in water over a six- to eight-hour period. Side reactions consist of chills, fever, nausea, vomiting, diarrhea, headache and elevated NPN. Recently it has been found just as effective to administer the drug on alternate days and cut untoward side reactions markedly. Its mechanism of action is unknown.

Griseofulvin also is one of the newer antifungal antibiotic agents. It was isolated

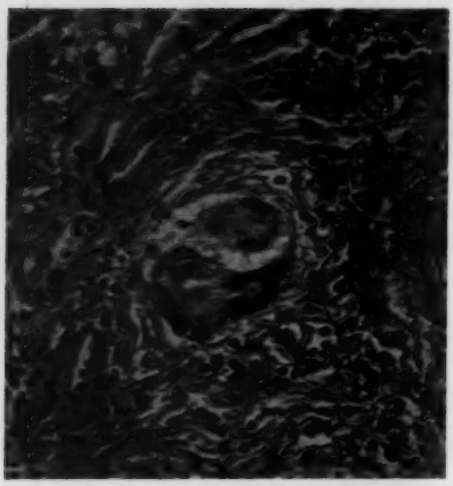

Fig. 3 (Bailey and Fulmer). Histologic section of tissue removed from sinus, demonstrating granulomatous reaction with multinucleated giant cells.

from Penicillium griseofulvin by Oxford, et al., 1939, and proved to be effective by oral administration in both the superficial and deep mycoses.[12] The usual adult dosage is 1.0 gm. daily and has been found to reach a blood concentration of 0.5 μg. per ml. of plasma. Toxic reactions reported have been minimal and consisted of headache, mild gastrointestinal discomfort, urticaria, and localized erythema. Its mechanism of action seems to be directly on the hyphae. There is no diffusion through the hyphae, as shown by the fact that hyphae contiguous with the inhibited zones, but not in direct contact with the drug, develop normally. This explains why treatment must be prolonged until the infected keratin material has been shed when treating the superficial mycoses.[13, 14]

Case summary

A 65-year-old white man (LR VA Hosp. #A 3190), a cotton-gin worker entered Little Rock Veterans Hospital for the first time November 4, 1958, because of trouble with his right eye. Symptoms first began in June, 1958, when he noticed numbness of the right side of the face and lip. Two months prior to admission there was burning and watering of both eyes, and one month later diplopia was noted. One month prior to admission the patient was hospitalized elsewhere for a foot injury and proptosis of the right eye was found. Pain in the region of the right eye and maxillary sinus gradually appeared and, while in the hospital, sinus irrigation was carried out, affording some temporary relief.

At the time of admission to the Veterans Hospital, the pain about the right eye and right maxillary sinus was dull in character and constant. Diplopia was constant. On examination the right eye was seen to be deviated externally and markedly proptosed, the eyelids touching the lens of his glasses. No tumor mass was seen or palpated, although the proptosis was resistant to counterpressure. Visual acuity was: R.E., 20/40; L.E., 20/20. The tension was normal to palpation. The pupil of the right eye was dilated and reacted only slightly to light. A paresis of the III cranial nerve could be demonstrated and questionably some weakness of the IV. There was decreased corneal sensitivity and decreased sensation to pin prick over the right supraorbital region.

Ophthalmoscopic examination revealed no abnormality except some fullness of the retinal veins as compared to the left eye. The left eye was normal.

Routine admission laboratory work was within normal limits except for an elevated sedimentation rate of 22. X-ray films revealed a destructive lesion of the lateral wall of the right maxillary sinus with marked dilatation of the infraorbital foramen. There was increased soft tissue density of the entire right orbit and antrum. Optic foramen was normal. X-ray films of the chest showed a fibronodular infiltrate in the right infraclavicular region with thin-walled honeycombing. Radiating strands from the lesion of the right hilum were also noted. It was believed that the patient had a malignancy destroying the wall of the maxillary sinus and secondarily invading the right orbit.

On November 19, 1958, a Caldwell-Luc procedure was done under local anesthesia. The wall of the antrum was partially destroyed and the antrum was filled with a fibrinous mass and pus. The entire specimen was fixed in formalin. Histologic examination revealed a granulomatous mass without evidence of carcinoma or lymphoma. Study of slides stained by the Gridley method revealed septate mycelia with some attempt at spore formation in the tissue.

Since no culture had been obtained from the first specimen, on December 4, 1958, a second Caldwell-Luc was done under general anesthesia. On re-opening the antrum it was found that the mass had completely filled the sinus. Tissue was taken under sterile conditions to the laboratory where a portion of it was ground and used to inoculate fungus media. The remaining portion of the specimen was submitted for histologic study. Fungus culture grew out Aspergillus flavus. Sections and cultures were submitted to the AFIP for confirmation of the finding of Aspergillus flavus. At the time of correspondence with the AFIP, February 17, 1959, in only one of similar cases had a fungus

been isolated and identified as a species of Aspergillus. Multiple sputa from the patient in our hospital were cultured for fungus and acid fast bacilli but all were negative, and no mycelia were found on smears.

Treatment

On January 8, 1959, skin testing was carried out on the patient, using a material prepared from the Aspergillus isolated. He was found to be positive and desensitization was then carried out prior to instituting any therapy. Sensitivity studies were carried out using amphotericin-B and nystatin. Amphotericin was found to be fungistatic in concentrations of 0.1 μg., 1.0 μg., and 10 μg./cc. of medium. On January 30, 1959, daily infusions of amphotericin-B were begun and gradually increased to a maximum of 70 mg. per day. The patient developed some febrile reactions to the infusions but not severe enough to stop the therapy.

He received daily infusions for approximately one month, during which time the only abnormal laboratory evidence of toxicity was a gradually increasing NPN to 63 mg. percent on February 13, 1959, approximately two weeks after beginning therapy. During the month of therapy with amphotericin, the patient appeared to have some slight decrease in proptosis, although his vision steadily decreased, first losing central vision and progressing to complete blindness in the right eye.

To gauge therapeutic value, blood samples were taken from the patient before, during, and a few hours after amphotericin infusions, and used as a culture medium into which was inoculated the Aspergillus from the original cultures. There was no detectable inhibition of growth. Because of lack of clinical improvement and no demonstrable inhibition of growth by the attainable blood levels of amphotericin, the therapy was discontinued.

On March 2, 1959, therapy consisting of a saturated solution of potassium iodide was instituted and gradually increased to 40 drops three times daily. Gastrointestinal symptoms

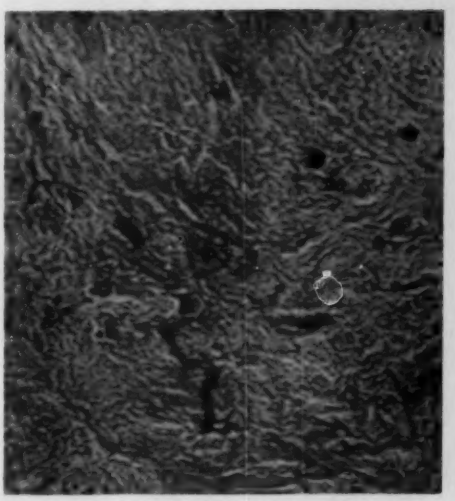

Fig. 4 (Bailey and Fulmer). Aspergillus hyphae demonstrated by Gridley stain.

were prominent, some swelling of the salivary glands was present, and the patient complained of a metallic taste. The patient was kept on saturated solution of potassium iodide for a period of eight months, it being discontinued temporarily on one occasion because of a skin rash.

Sensitivity studies were carried out using griseofulvin and showed significant inhibition of growth in concentrations of 0.1 and 1.0 and 10.0 μg./cc. of medium. On November 16, 1959, the patient was started on griseofulvin, receiving 2.0 gm. daily in divided doses by mouth. There was some improvement in the patient's pain and he was able to discontinue the use of codeine. On January 14, 1960, the dosage was reduced to 1.5 gm. daily. No attempts to measure blood levels were carried out. There has been no significant change in the appearance of the eye. Exophthalmometer measurements are 23 mm. on the right and 14 mm. on the left. X-ray follow-up on the chest lesion over this period of time has shown some improvement. The patient's general health has remained good.

Discussion

The response of systemic Aspergillosis to any form of therapy is quite poor despite the fact that in vitro studies demonstrate a sensitivity of Aspergillus to a number of agents.[15] Where as penicillin has been found to have no inhibiting effect on Aspergillus, the sulfonamides, streptomycin, oxytetracycline, chlortetracycline, tetracycline, chloramphenicol, erythromycin, and potassium iodide have been found to be fungistatic. Amphotericin-B, nystatin and griseofulvin are also fungistatic. Mercuric iodide red is the only agent that has been found to be markedly fungicidal.

The Aspergillus fungus isolated from this case did not show in vitro sensitivity to streptomycin, penicillin, nystatin and chloramphenicol. Although this organism was shown to have in vitro sensitivity to amphotericin-B, little clinical improvement was obtained by this medication. This probably was due to the fact that sufficient blood levels of the drug could not be obtained to give a fungistatic effect on the Aspergillus. Griseofulvin had an inhibitory effect on the fungus in vitro and also resulted in subjective improvement when administered to the patient. However, there was little objective improvement of the lesion. Evidently the griseofulvin was able to check the spread of the fungus and was actually able to cause some regression of the inflammatory reaction by its fungistatic activity. The failure to effect very much objective change was probably due to an inability of the griseofulvin to penetrate into the central mass of the mycotic lesion. Hence its fungistatic activity was limited to the peripheral areas of the lesion.

Conclusion

A case of Aspergillus of the right maxillary sinus secondarily invading the orbit is presented. Diagnosis was established by histologic study and culture of tissue removed from the sinus. The patient was initially treated with intravenous amphotericin-B with little or no retardation of the disease process. Potassium iodide was then given by mouth over an eight months' period with some subjective improvement. Griseofulvin therapy has resulted in more patient relief than systemic iodides.

University of Arkansas
Medical Center.

Addendum

Since this paper was submitted for publication, the patient showed a gradual downhill course and died on December 3, 1960, 32 months after the onset of his disease. Autopsy showed direct extension of the infectious process through the roof of the orbit and along the base of the brain.

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CLINICAL INVESTIGATION OF CORNEAL CONTACT LENSES

HERVE M. BYRON, M.D., AND ALAN C. WESELEY, M.D.
Elmhurst, New York

The first corneal-type lenses were utilized by E. Kalt in 1888. A. Muller coined the term corneal lens and wore the first pair which were made for him by Himmler, a German optician in 1899. Carl Zeiss produced corneal lenses for the first time in 1912. Until 1938, because of their weight corneal lenses could not be worn successfully. In that year, Obrig and Mullers demonstrated that the use of plastic instead of glass in contact lenses reduced the weight to about one third and eliminated the danger of shattering glass.

The renaissance of corneal contact lenses occurred in 1948 when Tuohy introduced the fluidless lens with a bevel at its marginal edge on the concave side. His lenses possessed no original features but he is generally credited with stimulating the present trend in the use of corneal contact lenses. Since 1948, six basic types of corneal lenses have appeared.

TYPES OF CORNEAL LENSES

1. *Vent-air lens.* This lens has four grooved parts on the concave side and at the edge. It is fitted 0.1 to 0.2 mm. flatter than the flattest corneal curvature. A central area of contact between lens and cornea of 3.0 to 4.0 mm. is advisable.

2. *Para-curve lens.* This lens is designed to conform to the shape of the cornea both centrally and peripherally. The posterior surface of the lens is fitted to conform to the curvature of the cornea.

3. *Stimson lens.* This lens possesses a posterior surface which may be toroidal or partly spherical. In either shape, two or more facets are ground on the concave side near the periphery. These facets are the only portion of the lens which rest on the cornea. The combination of the facets and the symmetrical surface of the concave side of the lenses serve to maintain the lens correctly on the cornea.

4. *Microlens.* This lens is smaller and thinner than types 1, 2, 3 or 6. The lack of lid resistance due to the lightness and thinness of the edges allows these lenses to adhere to the cornea. This lens must be fitted flatter than the larger corneal lenses in order to effect proper movement. An area of central contact of 3.0 to 6.0 mm. is desirable. The edges of the microlenses stand farther away from the cornea than other corneal lenses. Microlenses usually do not possess an inside bevel. However, a bevel of 1.0 to 2.0 mm. may be ground into these lenses for patients with two or more diopters of astigmatism or for patients on whose corneas the lenses do not ride properly. A well-rounded edge is essential to the comfortable wearing of these lenses.

5. *Para-thin microlens.* Two major posterior surfaces are found on this lens: the central, which is curved to fit the central

part of the cornea, and the peripheral. The two surfaces form a parabolic curve. The fitting of this lens is similar to the fitting of the para-curve corneal lens.

6. *Sphercon lens.* This lens is designed to parallel the central optical zone of the cornea. The adverse effects of a constantly moving lens are eliminated because the design of the lens keeps it centered on the cornea. The cornea tends to change less rapidly in curvature with this lens. It is essential that the edges of this lens stand away from the cornea in order to allow a sufficient flow of tears beneath the lens. A bevel is ground around the periphery of this lens.

The number of corneal contact lens wearers is rapidly growing. The number of potential wearers is prodigious. Today ophthalmologists are frequently asked to advise and prescribe for patients who desire this type of visual aid.

What clinical tests may be used to predict whether these lenses will be worn successfully? What are the effects of these lenses? What precautions should be taken when they are worn? In trying to learn the answers to these questions by reviewing the English-speaking ophthalmic literature, we were impressed by the paucity of clinical investigations relating to these problems. Several studies had been conducted by sending questionnaires to patients who were wearing these lenses and/or these patients had been interviewed. However, in few studies was there an examination of patients using corneal lenses.

To answer the questions already stated, we conducted a clinical investigation of 54 patients who wore corneal contact lenses. Certified contact lens fitters measured the majority of patients at the New York Eye and Ear Infirmary. The remaining patients were gathered from several outside sources where they were also fitted by qualified technicians.

These patients were initially studied without wearing their lenses for at least 24 hours. They were then re-evaluated after wearing the lenses for at least four hours. The examination of these patients included changes in corneal sensitivity, presence of corneal staining, changes in intraocular pressure and, in 10 patients, tonographic studies before and after the use of these lenses.

Investigation

I. Material

Letters were sent to 165 patients who were fitted in the contact lens clinic at the New York Eye and Ear Infirmary: 31 patients responded and appeared for study; 37 patients informed us that they had discontinued using their contact lenses. It was impossible to ascertain the reason in most of these cases. The other 25 patients studied were obtained from outside sources. Two of the 56 patients examined wore scleral lenses and, consequently, were excluded from the study. In the 54 patients comprising this investigation, 97 of the possible 108 eyes were fitted to corneal lenses. Satisfactory fitting patterns in these 97 eyes, as tested with fluorescein, were demonstrated before the eyes were included in this study.

The patients were asked the following questions at the time of the initial interview: (1) Reason for using corneal contact lenses; (2) initial tolerance to their lenses; (3) length of adjustment period; (4) average wearing time per day; (5) presence of any annoying symptoms while wearing or after the removal of the lenses; (6) occurrence of any acute episodes related to the use of the lenses.

A 24-hour period of abstinence from the use of the lenses preceded the first examination of the patients. This examination included: (1) Visual acuity without correction and with spectacle correction (at the second examination, vision was tested with the corneal contact lenses); (2) external appearance and conjunctiva; (3) cornea, with and without fluorescein; (4) corneal sensitivity as measured by the use of Frey hairs; (5) iris

and anterior chamber; (6) angle with a Goldmann gonioprism; (7) fundus; (8) intraocular pressure as measured with a Schiøtz tonometer; (9) tonography in 10 patients; (10) central fields and blindspot determination.

The same examination was repeated at a later date after the patient had worn the corneal lenses for at least four hours. This second examination was performed by the same examiner in order to minimize inherent errors of technique.

II. Results

Patients 17 and 44 are omitted in compiling the results because they were wearing scleral lenses.

1. *Indications.* Thirty-nine of the 54 patients wore corneal lenses because of myopia; 11 patients because of aphakia. Keratoconus was the indication of three patients and compound hyperopic astigmatism in one patient.

2. *Initial tolerance.* Thirty-three of the patients stated that their initial tolerance was good to excellent, which meant that they experienced minor discomfort when inserting the lenses in the early stages of use. Fair tolerance (bearable discomfort after insertion of the lenses) was claimed by 14 of the patients. Five stated that they could not initially tolerate the lenses for more than a few minutes. Two patients indicated that the tolerance for their left eye was good but that the right eye could not initially tolerate the lenses.

3. *Length of adjustment period.* These patients were arbitrarily divided into three groups according to the adjustment period which is based on the time required to wear the lenses comfortably for four hours: (1) three months or less; (2) more than three months; (3) never fully adjusted.

Of the 54 patients, 46 were wearing the lenses comfortably within three months for at least four hours. Only four patients required more than three months to reach this stage. Three of the patients never fully adjusted to the lenses. One patient adjusted to the lens in one eye but could not adjust to the lens in the other eye.

4. *Average wearing time.* Of the 54 patients, 31 claimed that they wore the lenses for more than eight hours each day, whereas 23 stated that they usually wore their corneal lenses fewer than eight hours per day.

5. *Presence of annoying symptoms.* Of the 54 patients, 41 wore the lenses asymptomatically. The other 13 patients (22 eyes) complained of burning (the most common symptom), blurring, irritation, foreign body sensation, dry sensation, headache, tearing and the visualization of grease spots. Seven of these 13 patients stated that the symptoms occurred after at least four hours of wearing the lenses. Patient 4 stated that blurring of her left eye occurred continuously whether she wore a corneal or scleral lens (which she used interchangeably). Patient 3 noted headaches and tearing after wearing both lenses for eight hours but not when she wore either lens alone. Four of the 13 symptomatic patients stated that they had symptoms occasionally. None of the patients noted any difficulty after removal of their lenses.

6. *Other pertinent history.* Patient 1 experienced blurring of vision for two weeks while wearing her corneal lenses. This symptom disappeared spontaneously and did not recur. Patient 3 switched from lacrilenses to corneal lenses. Patient 4 used lacrilenses and corneal lenses interchangeably. She voluntarily stated that she could feel her corneal sensitivity diminish after the use of her corneal lenses.

Patient 6 experienced an attack of acute glaucoma seven months after the corneal lenses were prescribed. She was treated with pilocarpine for two weeks. She has not used the medication since then and has not experienced a recurrence. She wears her lenses for 10 to 12 hours per day. Patient 8 changed her corneal lenses frequently because she claimed that the lenses did not fit her properly after a few months use.

Patient 11 changed from scleral to corneal lenses. She experienced an episode of den-

dritic keratitis in January, 1960. Patient 21 suffered from an incipient attack of iritis in her right eye in November, 1959. The iritis responded to treatment. She had tried many types of lenses but none felt comfortable.

Patients 23, 35, 46 and 52 tolerated their lenses during the first five months of pregnancy. However, after this stage of their gestation period, they all noticed troublesome symptoms when wearing their lenses. None of the five women could tolerate wearing their corneal lenses for the remainder of the pregnancy.

Patient 28 switched from scleral to corneal lenses. Patient 31 is an identical twin. Both twins are high myopes. When examined initially in the clinic, neither girl had ever worn any type of correction for the myopia. Corneal lenses were prescribed for this girl, whereas her sister was given conventional glasses.

Patient 49 underwent a lamellar corneal transplant four months before he started to wear his lenses. Patient 50 suffered from optic neuritis six months after he had a cataract extracted from his left eye and four months after he started to wear his corneal lenses. Patient 55 had primary optic atrophy in his right eye.

7. *Effect on visual acuity.* Sixty-four of the eyes tested with the standard Snellen number chart revealed better visual acuity with corneal lenses than with conventional spectacles; 21 of the eyes showed no difference between these two types of visual aides. Seven eyes demonstrated inferior vision with corneal lenses. Six patients did not own spectacles.

8. *External appearance and conjunctiva.* No unusual changes were found on examining any of the eyes before or after the use of corneal contact lenses.

9. *Corneal changes.* We detected corneal staining in 52 eyes after use of the corneal lenses. No staining with fluorescein was observed in these 52 eyes before wearing the lenses. Of these 52 eyes, 36 tolerated corneal lenses asymptomatically. In the remaining 16 eyes, the patients complained of symptoms after the use of corneal lenses.

Examination of 43 eyes showed no staining before or after the use of corneal lenses. Three of these eyes revealed the presence of cornal epithelial edema after use of corneal lenses. Of these 43 eyes, 37 tolerated the corneal lenses asymptomatically.

We found staining in two eyes before and after the use of the lenses. In all eyes examined, the corneal staining was limited to the superficial layers and was either punctate or linear in appearance.

Two patients included in this survey appeared in the emergency room of the New York Eye and Ear Infirmary with large central corneal abrasions (in the left eye of one patient and in both eyes of the second) following the prolonged use of their corneal lenses.

10. *Corneal sensitivity.* Fifty normal patients were tested with Frey hairs to determine their corneal sensitivity. All 100 eyes examined reacted to the 1.0 gm. or 2.0 gm./mm.^{2} hair.

Table 1 illustrates the range of sensitivity of the 97 eyes examined for the survey. Seventy-nine eyes were less sensitive after at least four hours' use of corneal lenses. The most striking examples of this decrease in sensitivity were in Patients 4, 21 and 48.

Seventeen eyes showed the same threshold of sensitivity after exposure to the lenses. Only one eye, the left eye of Patient 5, demonstrated a more sensitive cornea after wearing the corneal contacts.

11. *Iris, anterior chamber and fundi.* No pertinent changes related to the use of corneal lenses were noted in these structures.

12. *Angle.* The angles of all 97 eyes of these 54 patients were open before and after the use of the lenses.

Examination of Patient 6, who previously had an attack of acute glaucoma, revealed narrow synechias, O.D. Examination of Patient 14, aphakic O.D., showed nasal synechias. Examination of Patient 15, who had cataracts extracted, O.U., revealed broad-

based synechias superiorly and inferiorly, O.D. Examination of Patient 18 revealed open angles, O.U., but pseudosynechias, O.D., and broad-based synechias, O.S.

Examination of all the patients with keratoconus revealed deep angles with pseudosynechias in the right eye of Patient 3, in both eyes of Patient 41 and Patient 45. Pseudosynechias were also found in the angles of Patients 27 and 29, who were myopes.

By pseudosynechias, we refer to what Gorin and Posner call iris processes in their book on gonioscopy: "thin strands of iris stroma bridging the angle between the periphery of the iris and either the ciliary body or trabecular meshwork."

13. *Intraocular pressure.* An increase in intraocular pressure was noted in 36 eyes after the use of corneal lenses. Forty eyes showed a decrease in tension. The remaining 21 eyes revealed no change.

An elevated intraocular pressure was detected before the use of corneal lenses only in the left eye of Patient 18. Tonography performed on this eye showed that the facility of outflow was impaired and the P_o/C ratio was increased. This patient refused treatment and could not be persuaded to return for further study.

The following patients' intraocular pressure were suspiciously high after they had worn their corneal lenses:

Patient 9—tension increased, O.S., from 15 mm. Hg to 20 mm. Hg after four hours. This patient was unable to co-operate sufficiently for tonography.

Patient 22—tension increased, O.D., from 15.6 mm. Hg to 25.6 mm. Hg after nine hours. His tension had been recorded two years previously and at that time, it was 23 mm. Hg, O.D. Tonography was done on this patient before and after the use of his lens in the right eye. The initial tension was the same each time but his facility of outflow in this eye improved considerably after wearing his lens.

Patient 39—tension increased, O.D., from 15.6 mm. Hg to 19 mm. Hg after five and one-half hours. Tonography indicated that the facility of outflow in this eye was slightly decreased after the use of her lens but that the P_o/C ratio was within the normal range.

TABLE 1

RANGE OF CORNEAL SENSITIVITY IN 97 EYES OF 54 PATIENTS BEFORE WEARING CORNEAL LENSES AS MEASURED BY FREY HAIRS

Corneal Sensitivity (in gm./mm.^{2})	Number of Eyes
1–2	34
5	25
10	15
20	8
30	4
50	4
100	2
200	1
More than 200	4

14. *Tonography.* Ten patients consented to tonography before and after the use of their corneal lenses. The facility of outflow improved in 10 of the eyes after the use of the corneal lenses. The facility of outflow decreased in eight eyes and remained the same in one eye. Unexpectedly, the outflow values were low in several eyes but the P_o/C ratio was increased to greater than 100 in only one eye. In this particular case, the diagnosis of chronic simple glaucoma was definitely established but was unrelated to the use of the corneal lenses. In two eyes with decreased outflow after use of the lenses, the C value fell to 0.22 but the P_o/C and fields were normal. The tracings of the pregnant females were unremarkable.

15. *Perimetry.* Most patients naturally showed a slightly larger field with their corneal lenses than with their conventional spectacles. No patient demonstrated any scotoma after wearing corneal lenses which was not present during the initial examination.

Abnormalities were detected in the following patients:

Patient 4—temporal construction of the central field, O.D., and enlarged blindspots, O.U. Patient 6—superonasal relative scotoma, O.D., superotemporal relative scotoma,

O.S., enlarged and bared blindspot, O.D. Patient 18—slight increase in blindspot, O.S. Patient 20—slight increase in blindspot, O.D. Patient 41—generally constricted fields when wearing spectacles.

Survey of literature

Before discussing the results of this study, a cursory review of the pertinent reports found in the literature related to the problems of contact lenses will be presented.

Williamson-Noble[1] surveyed a large number of patients by questionnaire without examining them in 1938. Many patients experienced blurring and veiling after a few hours use of the scleral type lens.

Mann,[2] in 1944, reported the use of scleral contacts for delayed mustard gas keratitis; 82 of 84 patients manifested improved visual acuity and, in 45, the relapsing nature of the disease was halted.

Dallos[3] stated, in 1946, that patients wearing lenses more than two hours develop haze and epithelial edema similar to the effects of increased intraocular pressure. Examination of these cornea revealed a stippled appearance which sometimes coalesced to form diffuse bullae. To overcome this problem, he suggested a new principle of fitting: a balanced fit with holes in the periphery of the scleral lens.

Pascal[4] devised a system of fitting scleral lenses, in 1947, based on the principle of a narrow rim of the lens touching the sclera instead of a lens whose weight was evenly distributed over the entire sclera.

Berens,[5] in 1949, published a report in the *Journal of the American Medical Association* about the problems of contact lenses. He directed a study made by the American Committee on Optics and Visual Physiology. Questionnaires were sent to physicians who were prescribing contact lenses. It is interesting to note the most frequent complaints listed by the physicians answering the questionnaire at that time: (1) Limited time that most patients can tolerate wearing the lenses; (2) solution is unsatisfactory for cleansing the lenses; (3) lenses are too expensive; (4) many patients who buy the lenses discard them because of dissatisfaction with them.

As a result of this study, the following recommendations were made:

1. National and local ophthalmological societies should regulate the prescribing of contact lenses and dissemination to the public of information regarding contact lenses.
2. The prescribing and/or fitting of contact lenses by persons not properly licensed under state or national law should be prohibited.
3. Medical opinion should be secured in every case before contact lenses are prescribed.
4. Ophthalmologists should establish standards for improving the fitness of technicians who wish to engage in fitting contacts. .
5. Competent impartial research should be initiated toward solution of unsolved problems concerning contact lenses. The main problem at present, provided the fit is correct, is hazy vision after wearing the contact lenses for some hours.
6. The public should be warned against those who advertise the superiority of their services or of any particular type of contact lens.

. Cross[6] analyzed the results of the use of scleral lenses in 1949. He found that 33 percent of 875 patients gave up using their lenses. The percentage of aphakics wearing their lenses was less than the percentage of myopes. People tolerated them more each day if a rest period of one hour per day were employed. He pointed out that the problem of Sattler's veils was the single greatest obstacle to the successful wearing of these lenses. This phenomenon occurred after three to four hours' wearing time and occurred more quickly upon reinsertion of the lens on the same day after a rest period.

Abraham and Shanedling,[7] in 1950, reported a clinical study of scleral lenses. In their report they mentioned the use of Tuohy corneal lenses. They cited three disadvantages of this type of lens: (1) Mobility of the lens, (2) difficulty of applying lenses to high ametropes and patients with keratoconus, (3) rather frequent presence of superficial keratitis even in cases without complaints. They stated "this superficial keratitis, although it usually disappears rapidly in a few hours, is a potential source

of danger to the patient especially in cases of pathologic conditions of the cornea."

Huggert[8,12] reported that a contact lens with a narrow haptic such as the Zeiss type can effect a considerable rise in intraocular pressure. He felt that this was one of the explanations for the occurrence of Sattler's veils.

Another explanation for Sattler's veils was published by Kinsey[9] in 1952. He explained corneal clouding after the use of the Dallos lens on a biochemical basis. Dilution of the hypertonic fluid used to insert the lenses by water from the tears and the cornea made this fluid isotonic with the cornea. The cornea then absorbed this fluid, thickened and became translucent instead of transparent, resulting in haze.

A comparative study of four types of contact lenses and spectacles by an Army Medical Research Laboratory[10] in 1952 revealed that, for use in the Armed Forces, the fluidless ventilated lens proved better than either the fluid or corneal types. The report indicated that the corneal plastic lens offered greater protection to the eye but that the greatest disadvantage stemmed from its poor wetting properties. The size of the lens, the ease of dislodgement and loss made it impractical for general use by the Armed Forces.

An excellent clinical investigation of 54 patients wearing Tuohy lenses was made by Berens, Girard and Foree[11] in 1953. They found: (1) Keratoconus and aphakic patients have less sensitive corneas than other patients; (2) 78.1 percent of patients wearing the Tuohy lenses were satisfied, whereas only 57.5 percent wearing the conventional scleral type expressed satisfaction; (3) "corneal sensitivity appears to be the greatest factor in determining tolerance to the lens"; (4) 10 percent of patients manifested corneal damage because they attempted to wear the lenses too long or to increase their tolerance too rapidly. They described three patients who showed diffuse superficial punctate staining of the cornea asymptomatically.

In the same year, Strughold[13] reported that the eye showed only one type of response to mechanical stimuli, namely, pain. He stated that the pain sensitivity of the cornea varied considerably with the region tested: the center of the cornea has the lowest pain threshold of all the body regions. This threshold was 0.2 gm./mm.^{2} in the center to 2.0 gm./mm.^{2} in the periphery as tested by Frey hairs.

Smelser and Ozanics,[14] in 1953, felt that corneal thickening after the wearing of molded contact lenses was due to the imbibition of water between the fibers of the stroma. They found that another striking change in this series of experiments on guinea pigs was the depletion of glycogen supplies in the epithelium. This biochemical change was thought to precede the corneal edema.

Ridley[15] did a clinical survey on 600 National Health Service contact lens cases in 1953. All these patients wore molded plastic lenses produced individually from a mold taken of the patient's eye. All the lenses were either channeled or fenestrated for ventilation. All the patients used two-percent sodium bisulfite and 0.5-percent chlorobutanol. Of the 600 patients, 221 were considered completed cases. The successful wearing time for these 221 patients was 12 hours. Ridley claimed that this type of lens was better than the corneal type. He also doubted whether small children could ever be fitted with contact lenses.

Smelser and Chen,[16] in 1955, showed that conventional scleral contact lenses interfere with corneal metabolism as evidenced by an increase in lactic acid following the use of lenses. This accumulation in lactic acid resulted in inhibition of the metabolic water-removing mechanism, causing an increase in the water content of the cornea and therefore effecting clouding. They suggested that contact lenses may cause anaerobic conditions to prevail in corneal metabolism.

In 1955, Boberg-Ans[17] conducted a clinical examination of corneal sensitivity with

TABLE 2

RELATIONSHIP OF INITIAL TOLERANCE TO WEARING TIME EXPRESSED IN PERCENT OF EYES

Initial Tolerance	No. of Eyes	Wearing Time More Than Eight Hours (%)	Wearing Time Less Than Eight Hours (%)
Excellent-Good	57	47.4	52.6
Fair	27	40.1	59.9
Poor	13	7.7	92.3

a Nylon thread having a variable pressure gauge. Frey hairs were not used because they were subject to changes depending upon the moisture of the atmosphere. A slight decrease in sensitivity was detected in patients wearing microlenses after one to two hours' use. If the contact lens did not fit properly, the reduction in sensitivity was greater. It was found that the normal sensitivity should return two to three hours after removing the lenses.

Westsmith,[20] in 1958, conducted a study of patients' acceptance of corneal microlenses. Of 1,230 patients who were sent a questionnaire, 613 responded. Ninety percent were wearing their lenses and 10 percent were not using them; 70 percent of those wearing the lenses used them for more than eight hours a day. He found that patients doing near work tolerated the lenses better than those doing far work. Males were not as successful in wearing the lenses as females. The greater the astigmatism, the more the myopia (greater than five diopters), the better the patients tolerated the lenses. Patients who had worn spectacles for a long time were not so successful with the microlenses as those who had worn glasses for a short period of time.

Agatston, Barnert and Feldstein[22] in 1960 wrote an excellent article about corneal lenses in ophthalmic practice. They state that 70 to 80 percent of patients can tolerate these lenses for more than eight hours a day and that more than 50 percent wear the lenses all day. They cite the role of the ophthalmologist in prescribing these visual aides. They review the technique of fitting, the indications, contraindications and pitfalls in the handling of patients. Corneal insensitivity is a contraindication according to these authors, who state that a more suitable fit must be found for the patients who demonstrate corneal staining after the use of lenses. If corneal staining persists despite measures to correct the fit, they advise terminating the use of the lenses.

DISCUSSION

It is not the intent of this investigation to evaluate specific corneal contact lenses. Therefore, the corneal lens worn by each patient is purposely omitted. We are primarily concerned with factors which may be used to predict which patients will wear the lenses successfully, with the effects of these lenses and with the precautions pertinent to the use of these lenses.

In our series, the indications for using corneal lenses are immaterial. An interesting observation is the successful fitting of two children, aged eight and 11 years. We were impressed by the ease of fitting and unusual facility of these young patients in learning how to use their lenses.

Of the 97 eyes examined, 58.8 percent exhibited good to excellent initial tolerance. By looking at Table 2, which relates the initial tolerance to the average wearing time per day, it will be observed that, for any given eye manifesting excellent tolerance, it would be impossible to predict how many hours a day that eye would tolerate the corneal lenses. However, eyes manifesting excellent tolerance as already defined stand a significantly better chance of tolerating the corneal lens for more than eight hours per day compared to those eyes demonstrating poor tolerance and a slightly better chance than those exhibiting fair tolerance.

Of the 54 patients interviewed, 85.2 percent experienced an initial adjustment period of less than three months before they could wear the corneal lenses comfortably for four

hours. Table 3 shows that the time for adjustment in this 85.2 percent could not be used alone to predict whether the patients would or could wear the lenses for eight or more hours. As inferred from Table 2, the only useful prognostic data available is negative: patients showing prolonged adjustment periods or those who never fully adjust to the use of their lenses are unlikely to tolerate their lenses for more than eight hours. Patients with short periods of adjustment wear them, statistically, for eight or more hours more frequently than the patients with longer adjustment time.

Although the initial tolerance and length of adjustment period may be considered prognostic factors, more negative than positive as we still would like to know what positive factors are available to explain why 57.4 percent of the 54 patients examined could wear their lenses for more than eight hours per day.

Of the eyes examined, 53.6 percent revealed corneal staining after exposure to the contact lenses for at least four hours. As already mentioned, 69.2 percent of these eyes tolerated the lenses asymptomatically despite this staining. Of the eyes examined 44.3 percent revealed no staining after wearing the lenses. Only 14.2 percent of these non-staining eyes had symptoms with the lenses. Of the eyes examined, 1.9 percent showed staining before and after the use of these lenses.

Thus, the first positive prognostic factor becomes apparent in Table 4 which relates

TABLE 3

RELATIONSHIP OF LENGTH OF ADJUSTMENT PERIOD TO WEARING TIME EXPRESSED IN PERCENT OF EYES

Length of Adjustment Period	No. of Eyes	Wearing Time More Than Eight Hours (%)	Wearing Time Less Than Eight Hours (%)
3 months or less	83	45.8	54.2
More than 3 months	7	28.6	71.4
Never fully adjusted	7	0	100

TABLE 4

RELATIONSHIP OF CORNEAL STAINING TO WEARING TIME EXPRESSED IN PERCENT OF EYES

Corneal Staining	No. of Eyes	Wearing Time More Than Eight Hours (%)	Wearing Time Less Than Eight Hours (%)
None	43	46.5	53.5
Present after but not before	51	35.3	64.7
Present before and after	3	66.7	33.3

corneal staining to wearing time. The percentage of eyes capable of tolerating the corneal lenses for more than eight hours a day with staining was significantly less than the percentage of eyes without staining. This large percentage of patients revealing corneal staining after the use of their corneal lenses was surprising. The large number of patients showing staining asymptomatically was even more interesting. These findings certainly justify McCaslin's[21] recent opinion that an optician should not attempt to fit anyone for contact lenses until he has an ophthalmologist's written permission. He also stated that the optician should work with the ophthalmologist in an ancillary capacity.

These findings also support the plea of Agatston, Barnert and Feldstein that ophthalmologists should be trained in the prescription and fitting of corneal contact lenses. Even if the ophthalmologist does not wish to prescribe the lenses himself, he should be capable of supervising a technician's work. These viewpoints reiterate what Berens so astutely advocated in 1949.

The relationship of corneal sensitivity to wearing time is important. Table 5 shows that patients with corneal sensitivity of 5.0 or more gm./mm.^{2} as measured by the Frey hairs before wearing corneal lenses are significantly more likely to tolerate these lenses for more than eight hours than patients with sensitivity less than 5.0 gm./mm.^{2} Thus, the second positive prognostic factor is uncovered.

TABLE 5

RELATIONSHIP OF CORNEAL SENSITIVITY (BEFORE USE OF CORNEAL LENSES) TO WEARING TIME EXPRESSED IN PERCENT OF EYES

Corneal Sensitivity	No. of Eyes	Wearing Time More Than Eight Hours (%)	Wearing Time Less Than Eight Hours (%)
Less than 5.0 gm./mm.^{2}	34	29.3	70.7
5.0 or more than 5.0 gm./mm.^{2}	63	46.0	54.0

The relationship of corneal sensitivity after the patient has worn the lenses for at least four hours to the wearing time is shown in Table 6. It is observed that no eye with a threshold less than 5.0 gm./mm.^{2} could tolerate the lenses for more than eight hours. It is improbable that the ophthalmologist will be able to predict the wearing time for a patient who manifests a threshold of corneal sensitivity greater than 5.0 gm./mm.^{2}

Of the eyes tested, 81.4 percent showed a higher threshold after the use of corneal lenses; 17.6 percent showed no change in the threshold; only 1.0 percent showed a lower threshold after the use of these lenses. This points to one of the effects of these lenses.

Only three patients (21, 39, 40) with staining exhibited a correlation between symptoms and corneal sensitivity. In the eyes of these patients, the corneal sensitivity remained acute after the use of corneal lenses, whereas the sensitivity of the fellow eye was markedly diminished and resulted in no symptoms. The remaining patients with staining exhibited no significant relation between alterations in corneal sensitivity before and after the use of these lenses and symptoms.

Since 37.1 percent of the eyes examined showed an increase in intraocular pressure, 41.2 percent revealed a decrease in tension and 21.7 percent were unchanged, there can be no conclusive statement as to the effect of these lenses on intraocular pressure. Only in the left eye of Patient 9, in the right eye of Patient 22 and in the right eye of Patient 39 did the tension increase to a range suspicious of glaucoma after the use of these lenses. The results of tonography excluded the diagnosis of glaucoma in two of these patients.

This is the first report of tonography performed on patients before and after the use of corneal lenses. From the results, no definite effect of these lenses on the facility of outflow can be postulated. We have no explanation at this time for the several facility of outflow values in the low normal range.

An interesting, and previously undocumented, observation resulting from this study is that the five of the 54 patients who were pregnant all indicated that their tolerance significantly changed during the second trimester of their pregnancy (about the fifth month). It is well established that the fluid content of the female body changes drastically during pregnancy. We suggest that the cornea participates in this dynamic state and undergoes changes in its curvature, thereby explaining this intolerance. Tonography in two of these pregnant patients revealed normal tracings before and after the use of their corneal lenses.

We should like to mention a study being conducted by one of us (H.M.B.) on Patient 31 who is an identical twin. Many ophthalmologists feel that corneal lenses may halt the progression of myopia if utilized early enough. These two young girls, both highly myopic, were seen before any type of visual aid had been prescribed for either one. Patient 31 was given corneal lenses to wear, whereas conventional spectacles were prescribed for her sister. Close study of these two girls has already revealed a difference in the progression of myopia. This study will be reported in another paper.

Concerning the precautions which must be considered by ophthalmologists when prescribing and treating patients with corneal contact lenses, we should like only to mention that patients who wear these lenses

successfully, even in the presence of slight corneal staining, need not necessarily discontinue the use of their lenses or change the lenses because of the staining. Frequent observation of these patients would appear to suffice, since many of our 54 patients undoubtedly manifested corneal staining for many months without any serious consequences. For other precautionary measures, we refer to the article by Agatston, Barnert and Feldstein.

TABLE 6

RELATIONSHIP OF CORNEAL SENSITIVITY (AFTER USE OF LENSES) TO WEARING TIME EXPRESSED IN PERCENT OF EYES

Corneal Sensitivity	No. of Eyes	Wearing Time More Than Eight Hours (%)	Wearing Time Less Than Eight Hours (%)
Less than 5.0 gm./mm.^{2}	5	0	100
5.0 or more than 5.0 gm./mm.^{2}	92	42.4	57.6

SUMMARY

A clinical investigation of 97 eyes in 54 patients (table 7) competently fitted with corneal contact lenses, 57.4 percent of whom wore their corneal lenses for eight or more hours per day and 75.9 percent of whom wore the lenses asymptomatically, was undertaken at the New York Eye and Ear Infirmary. A brief history and a cursory description of the six types of corneal contact lenses were presented. The study emphasized what clinical criteria are significant prognostic factors in the eventual successful wearing of these lenses, the effects of these lenses and what precautionary measures should be employed when the lenses are worn. A review of the contemporary English-speaking literature pertinent to contact lenses was also presented.

A thorough history and complete eye examination, including measurement of corneal sensitivity with Frey hairs before and after the use of these lenses, was performed on each patient. Tonography was utilized whenever possible in patients with elevated tensions.

Clinical criteria which serve as prognostic factors are:

1. Initial tolerance to the corneal lenses—patients with poor tolerance stand a remote chance of wearing the lenses for eight or more hours per day.

2. Adjustment period to the corneal lenses—patients exhibiting an adjustment period of more than three months are poor candidates for this type of visual aid.

3. Corneal staining after the use of corneal lenses—patients who do not exhibit superficial corneal staining have a significantly better chance (although small in our series) of tolerating the lenses for more than eight hours a day than those with staining.

4. Corneal sensitivity before and after the use of these lenses—patients with corneal sensitivity of 5.0 or more gm./mm.^{2} before wearing corneal lenses should be much more likely to tolerate these lenses for eight or more hours than those patients with sensitive corneas. No patient with a threshold of corneal sensitivity less than 5.0 gm./mm.^{2} after wearing the lenses for four or more hours could tolerate these lenses for more than eight hours in our series of 97 eyes. It would appear that corneal sensitivity offers a more reliable prognostic sign for successful use of corneal lenses than the presence or absence of corneal staining.

The effects of wearing corneal lenses are:

1. Of the eyes examined with corneal contact lenses, 66 percent revealed better visual acuity than with conventional spectacles.

2. Of the eyes examined after the use of the lenses for four or more hours, 53.6 percent showed corneal staining.

3. Of the eyes examined, 81.4 percent showed a higher threshold of corneal sensitivity after the use of corneal lenses.

4. No conclusive effect of these lenses on intraocular pressure could be detected.

5. Except for the larger field of vision ef-

(Continued on page 694)

TABLE 7

ANALYSIS OF CASES STUDIED

Case Sex Age (yr.) Indication	Initial Tolerance Adjustment Period Average Wearing Time (hr.)	Symptoms During or After Use of Lenses	Visual Acuity without, with Spectacles & Corneal Lenses and External & Fundus Examination	Corneal Staining	Corneal Sensitivity
				Before After	Before After
1. M. K. F 20 Myopia	Poor 5–6 6–7	None	20/200 O.U. 20/20 O.U. 20/15 O.D. 20/20 O.S. Normal	O.D.—negative O.S.—temporal staining O.U.—diffuse staining	O.U.— 2 O.U.—10
2. J. T. F 34 Myopia	Poor 3 yr. 6–8	None	5/200 O.U. 20/30+3—O.D. 20/30 —O.S. 20/30-2 O.U. Normal	O.U.—negative O.U.—diffuse staining	O.U.—2 O.U.—2
3. D. W. F 28 Keratoconus	Excellent Immediate 6–8	Headaches and tearing after 8 hr. use when wearing O.U., but not when wearing only one lens	2/200 O.U. 20/70 —O.D. 20/50 —O.S. 20/40–2 O.D.; 20/30—O.S. Normal	O.U.—negative O.U.—diffuse staining	O.D.—100 O.S.— 2 O.D.—150 O.S.— 50
4. R. K. F 30 Myopia	Fair to corneal but good to lacrilenses 1 mo. to corneal, 2 wk. to lacrilenses 3–5 hr. with corneal; 10 with lacrilenses	Constant blurring in O.S. with both types	3/200—O.D. 1/200—O.S. No spectacles 20/30 O.U. Myopic retinopathy	O.U.—negative O.U.—diffuse staining	O.U.— 20 O.U.—150
5. R. W. F 34 Myopia	Fair 8–10 wk. 8–12	None	10/200—O.D. 8/200—O.S. 20/30 O.U. 20/20 O.U. Normal	O.U.—negative O.D.—slight axial stain O.S.—same plus temporal edema	O.D.— 5 O.S.—10 O.U.— 5
6. H. S. F 41 Myopia	Excellent 3 wk. 10–12	Irritation O.U. after 10 hr.	1/200—O.D.; FC@5 ft. O.S. 20/70 —O.D.; FC@5 ft. O.S. 20/40 —O.D.; FC@10 ft. O.S. Normal	O.U.—negative O.U.—diffuse axial stains and abrasions	O.D.— 20 O.S.— 50 O.D.— 50 O.S.—100
7. J. C. F 37 Myopia	Fair Never completely adjusted 4	Irritation and burning O.U.	5/200—O.U. 20/30 —O.D. 20/20–1 O.S. 20/40 O.D. 20/100—O.S. Normal	O.U.—negative O.U.—negative	O.U.—1 O.U.—2
8. V. W. F 44 Aphakia O.S.	Good 1 yr. 5–7	None	20/30 —O.D.; FC@2 ft. O.S. No spectacles 20/30 —O.D. 20/40 —O.S. O.D.—normal O.S.—full iridectomy adherent in places to face of hyaloid	O.U.—negative O.U.—negative	O.D.— 2 O.S.—20 O.D.— 2 O.S.—50
9. R. B. F 17 Compound hyperopic astigmatism	Fair 1 wk. 3–6	Had trouble with left lens which was changed	20/70+20 O.D. 20/100 O.S. 20/20 —O.D. 20/70+1 O.S. 20/30+2—O.D. 20/70 —O.S.	O.U.—normal O.U.—normal	O.U.— 5 O.D.—10 O.S.—5
10. F. N. F 66 Aphakia O.U.	Good 8 mo. 10–12	None	3/200 O.U. 20/70—O.D.; 20/30—O.S. 20/30 O.U. Peripheral iridectomies O.U.	O.U.—normal O.U.—normal	O.U.—10–20 O.U.—20
11. E. E. F 40 Myopia	Excellent Immediately 12–14	None	10/200—O.D.; 8/200—O.S. 20/20 O.U. 20/20 O.U. Normal	O.U.—normal O.U.—normal	O.U.— 5 O.U.—10
12. E. M. F 45 Myopia	Excellent 4 wk. 6 hr. once per wk.	None	3/200—O.S. 20/30 —O.S. 20/30 —O.S. Normal O.S.	O.S.—normal O.U.—normal	O.S.— 5 O.U.—10
13. J. M. F 11 Myopia	Fair Still not complete 3–5	Occasional burning O.U.	8/200—O.D.; 5/200—O.S. 10/200—O.U. 20/200—O.U. Normal O.U. except for myopic retinopathy	O.U.—normal O.U.—normal	O.U.—5 O.U.—5
14. B. M. 59 Aphakia O.D.	Good 1–2 mo. 8–10 hr.	None	5/200—O.D.; 20/60—O.S. 20/30 —O.D.; 20/20—O.S. 20/30 —O.D. O.D.—pupil drawn up superiorly; early choroidal sclerosis	O.D.—normal O.D.—fine linear stains axially	O.D.— 5 O.D.—10–20

TABLE 7 *(Continued)*

Angle	Tension Before / After (mm.Hg)	Tonography Before / After	Perimetry Central Blindspot	Other Pertinent History
Open with pigmentation of trabeculae O.U.	O.D.—14.3 O.S.—18.5 O.D.—12.5 O.S.—12.5	O.D. T—14; C—0.26; Po/C—54 O.S. T—18; C—0.23; Po/C—70 — O.D. T—15; C—0.23; Po/C—70 O.S. T—19; C—0.28; Po/C—33	Normal—O.U. Normal—O.U.	One episode Nov. 1959 when vision O.S. with contacts became blurred lasting 2 wk. disappearing spontaneously
Open—O.U.	O.D.—17.0 O.S.—18.5 O.D.—15.6 O.S.—14.3	— Normal—O.U.	Normal—O.U.	Wears her corneal lenses 4–5 times wk.
Open—O.U. with pseudosynechias O.D.	O.D.— 7.5 O.S.—10.0 O.D.— 6.0 O.S.— 9.0	— Normal to 10 mm. test object—O.U. Cannot determine—O.U.		Wore lacrilenses 1947–1956; then switched to corneal lenses
Open—O.U.	O.U.—18.5 O.U.—13.1	O.D. T—19; C—0.30; Po/C—63 O.S. T—17; C—0.35; Po/C—48 O.D. T—18; C—0.32; Po/C—63 O.S. T—20; C—0.30; Po/C—67	Temporal constrictions of central field O.D.; generalized O.S., enlargement blindspots O.U.	Uses lacrilenses and corneal interchangeably. states cornea became insensitive after using corneal lenses
Open—O.U.	O.D.—18.5 O.S.—15.6 O.U.—18.5	— Normal—O.U. Normal—O.U.		None
Open—O.U. but 1 narrow synsynechia—O.D.	O.U.—15.6 O.D.—11 O.S.—16	September 1958 O.D. T—17; C—0.22; Po/C—77 O.S. T—21; C—0.41; Po/C—51 December 1959 O.D. T—11; C—0.25; Po/C—44 O.S. T—16; C—0.30; Po/C—53	Superonasal defect O.D. and superotemporal defect O.S. central fields Enlarged and bared blindspot O.D.; not obtainable O.S.	Had attack acute congestive glaucoma O.D. Sept. 1958. Lenses were prescribed in Jan. 1958. Treated with pilocarpine 2 wk. and not used lenses since. Refused any further work-up or treatment
Open—O.U.	O.D.—15.6 O.S.—18.5 O.U.—15.6	— Normal—O.U. Normal—O.U.		Wears corneal lenses 3 da. wk. 6 episodes iritis O.D. in childhood; last one was 9 yr. ago
Open—O.U. but iris adherent to cornea peripheral to iridectomy—O.S.	O.D.—15.6 O.S.—17 O.U.—17	— Normal—O.U. Normal—O.U.		Changes lenses frequently because after a few mo. use, become uncomfortable
Open—O.U.	O.D.—18.5 O.S.—15.6 O.D.—18.5 O.S.—20	Could not cooperate sufficiently — Normal—O.U. Normal—O.U.		Treated for esotropia, amblyopia and eccentric fixation O.S.
Open—O.U	O.D.—17 O.S.—14.3 O.D.—17 O.S.—14.3	— Normal—O.U. Normal—O.U.		None
Open—O.U.	O.U.—18.5 O.U.—15.6	— Normal—O.U. Normal—O.U.		Wore scleral lenses 1954–1959. Had attack herpes simplex O.D. January 1960
Open—O.S.	O.S.—18.5 O.S.—18.5	— Normal—O.U. Normal—O.U.		Retinal detachment & subluxation of hypermature cataract O.D.; prefers spectacles O.S. except for social events
Open—O.U.	O.U.—15.6 O.D.—14.3 O.S.—15.6	— Cannot obtain—O.U. Cannot obtain—O.U.		Has left esotropia and left hypertropia
O.D.—nasal synechias	O.U.—13.1 O.D.—10.9 O.S.—14.3	— Cannot obtain—O.D. Cannot obtain—O.D.		None

TABLE 7 (*Continued*)

Case Sex Age (yr.) Indication	Initial Tolerance Adjustment Period Average Wearing Time (hr.)	Symptoms During or After Use of Lenses	Visual Acuity without, with Spectacles & Corneal Lenses and External, & Fundus Examination	Corneal Staining	Corneal Sensitivity
				Before After	Before After
15. M. M. F 46 Aphakia O.U.	Excellent 3 wk. 10–12	None	4/200—O.U. 20/15 —O.D.; 20/20—O.S. 20/15 —O.U. Peripheral iridectomies O.U.	O.U.—normal O.U.—diffuse staining	O.U.—10 O.U.—20
16. R. S. F 25 Myopia	Fair 2 mo. 8–10	None	2/200—O.D.; 10/200—O.S. 20/20 —O.U. 20/20 —O.U. Normal	O.U.—normal O.U.—normal	O.U.—2 O.U.—5
17. M. D. F 25 Keratoconus	Good Immediate 14	Patient wears lacrilenses	20/200—O.D.; 10/200—O.S. No spectacles 20/30 —O.D.; 20/40–2 O.S. Normal	O.U.—no staining O.U.—diffuse staining	O.D.—2 O.S.—5 O.D.—2 O.S.—5
18. A. T. F 20 Myopia	Poor Still not complete 4–6	None	10/200—O.U. 20/20 —O.U. 20/30–2 O.D.; 20/20—O.S. Normal	O.U.—normal O.U.—diffuse staining	O.U.—10 O.U.—30
19. A. D. 25 Myopia	Fair 6 wk. 4–6	None	20/200—O.U. 20/30 —O.U. 20/20 —O.U. Normal	O.U.—normal O.U.—normal	O.U.— 5 O.U.—20
20. F. M. F 29 Myopia	Fair 2 wk. 12–15	None	20/200—O.D.; 5/200—O.S. 20/70 —O.D.; 20/100—O.S. 20/40 —O.D.; 20/70/—O.S. Normal	O.D.—normal O.S.—staining O.U.—diffuse staining	O.D.—10 O.S.—20 O.U.—50
21. R. R. F 31 Myopia	Fair 2 wk. 6–7	F.B. sensation & burning O.U. after few hours	15/200—O.D.; 18/200—O.S. 20/50 —O.U. 20/30 —O.U. Normal	O.U.—normal O.U.—staining diffuse	O.U.— 2 O.D.— 2 O.S.—30
22. D. T. M 76 Aphakia O.D.	Excellent Immediate 12–14	None	4/200—O.D.; 20/40—O.S. No spectacles 20/70 —O.D. Iridodenesis—O.D.	O.D.—diffuse staining O.D.—diffuse staining	O.D.—100 O.S.— 50 O.D.—150
23. E. C. F 33 Myopia	Excellent Immediate 5–6	Grease spots form O.U. after 12 hr.	10/200—O.U. 20/30 —O.D.; 20/50—O.S. 20/30 —O.D.; 20/40—O.S. Normal	O.U.—normal O.D.—slight punctate staining O.S.—abrasion centrally	O.U.—10 O.U.—10
24. M.D. 32 Myopia	Poor for O.D. but good for O.S. O.D.—incomplete O.S.—immediate 4	F.B. sensation O.D.	10/200—O.U. 20/40 —O.U. 20/30 —O.U. Normal	O.U.—normal O.U.—staining diffuse	O.D.—20 O.S.—10 O.D.—30 O.S.—50
25. J.M. F 21 Myopia	Poor—O.D. Fair—O.S. 2–3 wk. 12	None	10/200—O.U. 20/40 —O.U. 20/30 —O.U. Normal	O.U.—normal O.U.—diffuse staining	O.D.—20 O.S.—10 O.D.—30 O.S.—50
26. B. N. F 40 Myopia	Good 1 mo. 10–12	None	20/200—O.D.; 20/200—O.S. 20/70–1 O.D.; 20/100—O.S. 20/70 —O.U. Posterior subcapsular cataracts O.U.	O.U.—normal O.U.—normal	O.U.— 50 O.U.—100
27. M. A. F 20 Myopia	Good 1 mo. 4–6	Dry sensation O.U. after 4 hr.	10/200—O.D.; 15/200—O.S. 20/20 —O.U. 20/20–3 O.D.; 20/20–1 O.S. Normal	O.U.—normal O.U.—diffuse staining	O.D.—10 O.S.—30 O.D.—10 O.S.—30
28. T. C. M 32 Myopia	Good 3 wk. 12–17	None	10/200—O.U. 20/20 —O.U. 20/20 —O.U. Normal	O.U.—normal O.U.—central epithelial edema	O.U.— 5 O.U.—10
29. R. H. F 24 Myopia	Good 3 wk. 6–8	None	10/200—O.U. 20/40 —O.U. 20/20 —O.U. Normal	O.U.—normal O.D.—negative O.S.—diffuse staining	O.D.— 5 O.S.—10 O.D.—10 O.S.—30

TABLE 7 (*Continued*)

Angle	Tension Before After (mm.Hg)	Tonography Before After	Perimetry Central Blindspot	Other Pertinent History
O.D.—broad-based synechias sup. & inf. O.S. —open	O.D.—15.6 O.S.—18.5 — O.D.—15.6 O.D.—15.6		Normal—O.U. Normal—O.U.	None
Open—O.U.	O.U.—17 — O.U.—18.5		Normal—O.U. Normal—O.U.	Alternating exotropia
Open—O.U.	O.D.—15.6 O.S.—13.1 — O.U.—18.5		Normal—O.U. Normal—O.U.	Patient wears lacrilenses
O.O.—open with pseudosynechias	O.D.—18.5 O.S.—25.8	O.D. T—18; C—0.27; Po/C—70 O.S. T—27; C—0.19; Po/C—142	Normal—O.U.	Patient and parents told possibility of chronic simple glaucoma; refused further study or treatment
O.S.—open with broad-based synechias inf.	O.D.—18.5 O.S.—21.9	O.D. T—18; C—0.23; Po/C— 79 O.S. T—22; C—0.20; Po/C—110	Slightly enlarged—O.S.	
Open—O.U.	O.U.—18.6 — O.U.—18.5		Normal—O.U. Normal—O.U.	None
Open—O.U., excess pigment in trabeculae	O.U.—18.5 O.D.—13.1 — O.S.—15.6		Normal—O.U. Slightly enlarged—O.D.	None
Open—O.U.	O.D.—15.6 O.S.—18.5	O.D. T—15; C—0.22; Po/C—70 O.S. T—18; C—0.27; Po/C—70	Normal—O.U.	Patient had attack Iritis O.D. Nov. 1959, tried several types of lenses
	O.D.—20 O.S.—10	O.D. T—13; C—0.25; Po/C—52 O.S. T—19; C—0.28; Po/C—70	Normal—O.U.	
Open—O.U.	O.U.—15.6 O.D.—25.8 O.S.—23.1	O.D. T—17; C—0.22; Po/C—77 O.S. T—21; C—0.33; Po/C—51	Normal—O.D.	After 9 hr. vision O.D. blurs, after 12 hr. vision poor
		O.D. T—17; C—0.33; Po/C—51	Normal—O.D.	
Open—O.U.	O.U.—18.5	O.D. T—12; C—0.22; Po/C—55 O.S. T—14; C—0.30; Po/C—47	Normal—O.U.	Patient 6 mo. pregnant at time this exam. Two wk. ago lenses uncomfortable for first time
	O.U.—15.6	O.D. T—14; C—0.29; Po/C—64 O.S. T—14; C—0.29; Po/C—49	Normal—O.U.	
Open—O.U.	O.U.—10.9 O.U.—12 —		Normal—O.U. Normal—O.U.	None
Open—O.U.	O.U.—10.9 O.U.—12.5 —		Normal—O.U. Normal—O.U.	O.D. bothering patient time 2nd exam. Scheduled to have the fit checked
Open—O.U.	O.D.—13.1 O.S.—13.3 — O.U.—12.5		Normal—O.U. Normal—O.U.	None
Open—O.U. with pseudosynechias	O.U.—17 O.D.—15.6 O.S.—18.5 —		Normal—O.U. Normal—O.U.	None
Open—O.U.	O.D.—13.1 O.S.—15.6 — O.U.—18.5		Normal—O.U. Normal—O.U.	Patient wore lacrilenses before corneal lenses could tolerate 4 hr.
Open—O.U. with pseudosynechias	O.D.—17 O.S.—15.6 — O.D.—12.5 O.S.—14.3		Normal—O.U. Normal—O.U.	None

TABLE 7 (*Continued*)

Case Sex Age (yr.) Indication	Initial Tolerance Adjustment Period Average Wearing Time (hr.)	Symptoms During or After Use of Lenses	Visual Acuity without, with Spectacles & Corneal Lenses and External & Fundus Examination	Corneal Staining Before After	Corneal Sensitivity Before After
30. J. R. F 24 Myopia	Fair 1 mo. 6	None	5/200—O.U. 20/30 —O.U. 20/20 —O.U. Normal	O.U.—normal O.U.—diffuse staining	O.D.— 5 O.S.— 2 O.D.—10 O.S.—20
31. K. M. F 8 Myopia	Excellent 2 wk. 6–7	None	20/200—O.U. 20/80 —O.U. 20/40—O.D.; 20/50—O.S. Lower palpebral conjunctival hyperemia—O.U.	O.U.—normal O.U.—diffuse staining	O.D.—10 O.S.—20 O.U.—50
32. E. W. F 33 Aphakia—O.S.	Poor 6 wk. 4	None	20/30—O.D.; FC@1 ft.—O.S. No spectacles 20/30—1—O.S. Basal iridectomy—O.S.	O.S.—normal O.S.—normal	O.D.— 5 O.S.—30 O.D.— 2 O.S.—50
33. H. F. F 22 Myopia	Fair 2–3 mo. 4–6	Occasional discomfort O.U. after 4 hr.	20/200—O.U. 20/20+1—O.D.; 20/20—1—O.S. 20/20 —O.U. Normal	O.U.—normal O.U.—diffuse staining	O.U.—1 O.U.—5
34. S. F. F 34 Myopia	Good 2 mo. 4–6	None	15/200—O.D.; 10/200—O.S. 20/30 —O.U. 20/20 —O.U. Normal	O.U.—normal O.D.—normal O.S.—few stains	O.D.— 2 O.S.— 5 O.U.—20
35. M. B. F 34 Myopia	Good 3 wk. 6–8	None	10/200—O.U. 20/30 —O.U. 20/20 —O.U. Normal	O.U.—normal O.U.—normal	O.U.— 2 O.U.—10
36. T. S. M 26 Myopia	Good 1 mo. 8–10	None	16/200—O.D.; 18/200—O.S. 20/30 —O.U. 20/20 —O.U. Normal	O.U.—normal O.U.—normal	O.U.— 1 O.D.—10 O.S.— 5
37. F. A. M 30 Myopia	Excellent 1 wk. 8–12	None	8/200—O.U. 20/30 —O.D.; 20/20-3—O.S. 20/20 —O.U. Normal	O.U.—normal O.U.—normal	O.D.— 2 O.S.— 1 O.U.—10
38. P. D. F 24 Myopia	Fair 2–3 mo. 12	None	10/200—O.U. 20/30 —O.U. 20/20 —O.U. Subconjunctival hemorrhage—O.U.	O.U.—normal O.U.—diffuse staining	O.D.—10 O.S.—30 O.D.—30 O.S.—50
39. E. B. F 34 Myopia	Good 1 mo. 6–8	Occasional F.B. sensation	5/200—O.U. 20/30 —O.U. 20/20 —O.U. Normal	O.U.—normal O.D.—stains O.S.—normal	O.D.— 2 O.S.— 5 O.D.— 5 O.S.—20
40. H. S. F 29 Myopia	Good 2 wk. 6–8	Occasional discomfort O.S. after 4 hr.	20/200—O.U. 20/20 —O.D.; 20/30—O.S. 20/20 —O.U. Normal	O.U.—normal O.D.—normal O.S.—axial stain	O.U.— 5 O.D.—50 O.S.—20
41. J. G. F 29 Keratoconus	Good 2 wk. 8–12	None	3/200—O.D.; 4/200—O.S. 20/40 —O.D.; 20/50 —O.S. 20/30 —O.D.; 20/40 —O.S. Normal	O.U.—normal O.D.—normal O.S.—staining	O.D.— 5 O.S.— 2 O.U.—10
42. S. E. F 22 Myopia	Fair 1–2 mo. 4–6	None	15/200—O.U. 20/30 —O.U. 20/40 —O.D.; 20/30—1—O.S. Normal	O.U.—normal O.U.—diffuse staining	O.U.—2 O.U.—5
43. V. S. M 41 Myopia	Good 1 wk. 4–6	None	3/200—O.U. 20/40 —O.U. 20/20 —O.U. Normal	O.U.—normal O.U.—stains temporally	O.U.— 2 O.U.—10
44. D. S. M 22 Aphakia O.D.	Fair 2–3 mo. 6–7	None	3/200—O.D.; 20/40—O.S. 20/40 —O.D.; 20/30—O.S. 20/30 —O.D. Atrophy of iris O.D. with synechias to remaining lens capsule	O.U.—normal O.U.—normal	O.D.—20 O.S.— 1 O.D.—20 O.S.— 2
45. J. L. M 28 Keratoconus	Good 2 wk. 10–12	None	3/200—O.D.; 4/200—O.S. 20/60 —O.D.; 20/40 —O.S. 20/30 —O.U. Normal	O.U.—normal O.U.—slight staining	O.U.—2 O.U.—3

TABLE 7 (*Continued*)

Angle	Tension Before / After (mm.Hg)	Tonography Before / After	Perimetry Central Blindspot	Other Pertinent History
Open—O.U.	O.D.—14.3 O.S.—16 O.U.—15.6	—	Normal—O.U. Normal—O.U.	None
Open—O.U.	O.U.—17 O.U.—11	—	Cannot perform—O.U.	Patient identical twin, wears contacts; sister wears spectacles; both observed periodically
Open—O.U.	O.D.—14.3 O.S.—17 O.D.—12.5 O.S.—13.1	—	Normal—O.U. Normal—O.U.	Patient had recur. episodes uveitis O.S. prior to cat. ex.
Open—O.U.	O.U.—12.5 O.U.—15.6	—	Normal—O.U. Normal—O.U.	None
Open—O.U.	O.D.—18.5 O.S.—15.6 O.U.—18.5	O.D. T—18; C—0.23; Po/C—79 O.S. T—15; C—0.26; Po/C—59 O.D. T—18; C—0.27; Po/C—69 O.S. T—18; C—0.27; Po/C—69	Normal—O.U.	None
Open—O.U.	O.D.—12.5 O.S.—10.9 O.U.—15.6	—	Normal—O.U. Normal—O.U.	Difficulty wearing lenses during 2nd pregnancy; resumed wearing after delivery
Open—O.U.	O.D.—15.6 O.S.—17 O.U.—15.6	—	Normal—O.U. Normal—O.U.	None
Open—O.U.	O.D.—16 O.S.—18.5 O.U.—15.6	—	Normal—O.U. Normal—O.U.	Operation to correct an X-XT at 5 yr.
Open—O.U.	O.D.—10.9 O.S.—12.5 O.U.—12.5	O.D. T—10; C—0.24; Po/C—40 O.S. T—12; C—0.29; Po/C—40 O.D. T—12; C—0.29; Po/C—54 O.S. T—12; C—0.26; Po/C—46	Normal—O.U. Normal—O.U.	Wore lenses without difficulty until 1 mo. ago; after left lens replaced, couldn't tolerate lens O.D. 5th mo. pregnancy
Open—O.U.	O.D.—15.6 O.S.—18.5 O.D.—19 O.S.—18.5	O.D. T—16; C—0.30; Po/C—53 O.S. T—18; C—0.27; Po/C—69 O.D. T—19; C—0.28; Po/C—69 O.S. T—18; C—0.31; Po/C—60	Normal—O.U. Normal—O.U.	None
Open—O.U.	O.D.—10.9 O.S.—12.5 O.U.—15.6	—	Normal—O.U. Normal—O.U.	None
Open—O.U. with pseudo-synechias	O.D.—16 O.S.—14.3 O.U.—12.5	—	Normal—O.U. Normal—O.U.	None
Open—O.U.	O.D.—12.5 O.S.—14.3 O.U.—15.6	—	Normal—O.U. Normal—O.U.	Surgery for exotropia as a child
Open—O.U.	O.U.—15.6 O.D.—15.6 O.S.—18.5	—	Normal—O.U. Normal—O.U.	None
Open—O.U.	O.D.—15.6 O.S.—17 O.D.—15.6	—	Normal—O.U. Normal—O.U.	Patient uses lacrilenses
Open—O.U. with pseudo-synechias	O.D.—15.6 O.S.—12.5 O.U.—12.5	—	Normal—O.U. Normal—O.U.	None

TABLE 7 (*Continued*)

Case Sex Age (yr.) Indication	Initial Tolerance Adjustment Period Average Wearing Time (hr.)	Symptoms During or After Use of Lenses	Visual Acuity without, with Spectacles & Corneal Lenses and External & Fundus Examination	Corneal Staining Before After	Corneal Sensitivity Before After
46. H. N. F 28 Myopia	Poor 2–3 mo. 6–7	None	18/200—O.D.; 15/200—O.S. 20/30 —O.U. 20/20 —O.U. Normal	O.U.—normal O.U.—normal	O.U.—2 O.U.—5
47. J. W. M 43 Aphakia—O.S.	Excellent Immediately 10–12	None	20/20—O.D.; 2/200—O.S. No spectacles 20/30—O.S. Normal—O.U. except for peripheral iridectomy—O.S.	O.U.—normal O.U.—normal	O.D.— 1 O.S.—50 O.S.—50
48. D. W. M 24 Myopia	Fair 1 mo. 10–12	None	18/200—O.U. 20/30 —O.U. 20/30 —O.U. Normal	O.U.—normal O.U.—marked staining	O.D.— 2 O.D.— 5 O.U.—50
49. C. K. M 22 Corneal transplant—O.D., myopia—O.U.	Excellent 2 wk. 4–6	None	20/100—O.D.; 20/200—O.S. 20/50 —O.D.; 20/20 —O.S. 20/40 —O.D.; 20/20 —O.S. Normal	O.D.—clear graft O.S.—no stain O.U.—no stain	O.D.—>200 O.S.— 2 O.D.—>200 O.S.— 5
50. J. K. M 76 Aphakia—O.S.	Excellent 3 wk. 4–5	None	20/30—O.D.; 1/200—O.S. 20/40—O.D.; 20/30 —O.S. 20/30—O.D.; 20/25 —O.S. Keyhole iridectomy—O.S.	O.U.—Normal O.U.—diffuse staining	O.D.— 2 O.S.—200 O.D.— 5 O.S.—200
51. A. L. F 26 Myopia	Excellent 2 wk. 6–8	None	5/200—O.D.; 8/200—O.S. 20/40 —O.U. 20/20 —O.U. Normal	O.U.—normal O.U.—normal	O.U.—2 O.U.—5
52. G.L. F 28 Myopia	Good 1 wk. 6–8	Irritation—O.U. past 2 mo.	18/200—O.D.; 20/200—O.S. 20/30 —O.U. 20/20 —O.U. Normal	O.U.—normal O.U.—normal	O.U.— 5 O.U.—10
53. D. S. M 63 Aphakia—O.S.	Excellent Immediate 12–16	None	H.M.—O.D.; CF@1 ft. H.M.—O.D.; 20/20–O.S. 20/20—O.S. Mature cataract—O.D., peripheral iridectomy & aphakia—O.S.	O.U.—normal O.U.—normal	O.D.— 2 O.S.—200 O.D.— 2 O.S.—200
54. I. B. M 51 Aphakia—O.S.	Excellent Immediate 14–16	None	2/200—O.D.; CF@1 ft. 2/200—O.D. 20/20 —O.S. Mature cataract—O.D., peripheral iridectomy & aphakia—O.S.	O.U.—normal O.U.—normal	O.D.— 2 O.S.—200 O.D.— 2 O.S.—200
55. J. E. M 46 Myopia—O.S.	Good 4–6 wk. 12–13	None	Light perception O.D. 2/200—O.S. 20/70 —O.S. 20/30 —O.S. Myopic retinopathy—O.S. Primary optic atrophy—O.D.	O.U.—normal O.U.—normal	O.U.— 5 O.S.—10
56. M. C. F 42 Aphakia—O.D.	Excellent Immediate 8–10	None	2/200—O.D.; 20/30—O.S. 20/40 —O.D. 20/20 —O.D. Peripheral iridectomy—O.D., aphakia—O.D.	O.D.—normal O.D.—staining	O.D.—200 O.S.— 2 O.D.—200

TABLE 7 (*Continued*)

Angle	Tension Before After (mm.Hg)	Tonography Before After	Perimetry Central Blindspot	Other Pertinent History
Open—O.U.	O.U.—14.3 O.U.—14.3	—	Normal—O.U. Normal—O.U.	Patient 7 mo. pregnant. At 5th mo. lenses uncomfortable O.U. after 1 hr.
Open—O.U.	O.D.—12.5 O.S.—14.3	—	Normal—O.U. Normal—O.U.	None
Open—O.U.	O.D.—18.5 O.S.—16 O.U.—16	—	Normal—O.U. Normal—O.U.	None
Open—O.U.	O.D.—15.6 O.S.—17 O.U.—15.6	—	Normal—O.U. Normal—O.U.	Patient had interstitial keratitis O.D. as child; had a 7 mm. lamellar keratoplasty Aug. 1959
Open—O.U.	O.D.—12.5 O.S.—14.5 O.D.—15.6 O.S.—16	—	Normal—O.U. Normal—O.U.	Cat. ext. O.S. May, 1959. 6 mo. later optic neuritis, O.S.
Open—O.U.	O.D.—12.5 O.S.—14.3 O.D.—14.3	—	Normal—O.U. Normal—O.U.	None
Open—O.U.	O.U.—12.5 O.U.—15.6	—	Normal—O.U. Normal—O.U.	Patient 7 mo. pregnant. Tolerated lenses O.U. until 5th month. Then uncomfortable after few hours
Open—O.U.	O.U.—14.3 O.U.—14.3	—	Normal—O.U. Normal—O.U.	Cat. ext. O.S. April, 1958. Has arrested bilateral apical pulmonary tuberculosis
Open—O.U.	O.U.—17 O.U.—15.6	—	Normal—O.U. Normal—O.U.	Cat. ext. O.S. Nov. 1959
Open—O.U.	O.D.—14.3 O.S.—16 O.S.—16	—	Normal—O.U. Normal—O.U.	Optic atrophy—O.D.
Open—O.U.	O.U.—18.5 O.D.—16	—	Normal—O.U. Normal—O.U.	Cat. ext. O.D. Jan. 1960

fected by these lenses as compared to spectacles (no frames), no pertinent effects on the central fields or blindspots were detected.

6. Five of the 54 patients were pregnant. All complained of a decrease in tolerance to the lenses during the second trimester of gestation.

Since corneal lenses definitely depress corneal sensitivity and often cause asymptomatic benign corneal staining, periodic examinations by an ophthalmologist are recommended for all patients wearing these lenses. The presence of asymptomatic superficial corneal staining after at least four hours' wearing time does not necessarily warrant cessation of the use of these lenses but rather indicates more frequent checkups and closer supervision by the attending ophthalmologist. However, staining which is deteced shortly after the insertion of the corneal lenses indicates a poor fit and, therefore, warrants a change of lenses.

80-31 Broadway (73).

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OPHTHALMIC MINIATURE

Those spectacles should be preferred which show objects nearest their natural state, neither enlarged nor diminished, at the same distance, and with the same ease as could be seen before the eyes were impaired.

Alexander Alexander, *A Treatise on the Nature of Vision*, 1833.

NOTES, CASES, INSTRUMENTS

GLAUCOMA THERAPY WITH ECHOTHIOPHATE (PHOSPHOLINE IODIDE)

ARTHUR SACKS-WILNER, M.D.
AND
ERWIN SACKS-WILNER, M.D.
Trenton, New Jersey

Phospholine iodide is a white crystallin solid which is readily soluble in water and fairly stable for some time under normal room temperatures and longer if kept under refrigeration. It is a potent and relatively irreversible inhibitor of acetyl cholinesterase.

According to Koelle and Steiner in their studies of the central affects of Echothiophate, there was no evidence that phospholine would permeate the blood-brain barrier and therefore should not produce any central effects. Koff and Coon in their studies to determine the effects of Echothiophate centrally or peripherally concluded that the drug was a peripheral-acting anticholinesterase agent and therefore less likely to cause central symptoms as does DFP which acts both centrally and peripherally.

Because of its peripheral action there is a lowered incidence of systemic side-effects as shown by the studies of Leopold, Gold and Gold, Becher, Pyle and Drews, Lawlor, Lee, Seward and Albert, and our own series.

The powder is mixed and easily soluble in an isotonic diluent prepared as follows: Boric acid (U.S.P.) two percent; benzalkonium chloride (U.S.P.) 0.002 percent (1:50,000). This solution was autoclaved at 121°C. for 20 minutes. The entire contents of the vial (125 mg.) were dissolved in 50 cc. of the prepared diluent to give a 0.25-percent solution of phospholine iodide dispensed in 5.0 cc. vials with a dropper. Instruction to "keep in the refrigerator" was on each labelled vial.

Phospholine, being a powerful miotic, has such attendant side-effects as brow-headache, pain in the globe, and blurring of vision. Only one patient complained of nausea and headache severe enough to necessitate discontinuing therapy with 0.25-percent phospholine. It is possible that reduction in the potency to 0.125 may obviate these complaints in some patients and further study should be carried out. In evaluating the effectiveness of phospholine it becomes apparent that the testing of ocular tension with a tonometer, fields and vision are the practical means by which ophthalmologists in daily office practice determine whether or not a patient's glaucoma is controlled; therefore, tonometric readings were made using 25 mm. Hg as the high normal, fields were taken every two months, and visual acuity and tension at each visit. The study is analyzed in Table 1.

RESULTS

Thirty-four patients with glaucoma were investigated. Open-angle chronic, simple glaucoma was present in 32 eyes. Eighteen eyes were controlled with phospholine alone or combined with Carcholin when other agents failed. Three were uncontrolled with any therapy and required surgery.

Thirteen aphakic eyes with glaucoma were treated with phospholine and controlled with a minimum number of instillations.

One eye with acute congestive, angle-closure, narrow-angle glaucoma was not controlled and required surgery. Three eyes with chronic simple glaucoma were not controlled and required surgery.

Four eyes with absolute glaucoma were treated. The tension remained elevated but the eyes were quiet and no painful symptoms were experienced.

CONCLUSIONS

Echothiophate (phospholine iodide) is another drug that can now be added to those used in the treatment of glaucoma. It may be combined with Carcholin and Diamox or

TABLE 1

ANALYSIS OF STUDY WITH ECHOTHIOPHATE

Case No.	Patient	Diagnosis	Therapy	Results
1	S. W.	Aphakia (diabetic) O.U., glaucoma, O.D., (corneal edema)	Pilo., eserine Mecholyl, DFP—uncontrolled. Diamox, phospholine 0.25% with Carbomiotin once daily	Controlled
2	H. S.	Open-angle glaucoma, chronic simple	Uncontrolled with pilo., eserine, Carcholin. Phospholine, 0.25% once nightly	Controlled. Blurring vision
3	M. A.	Aphakia, glaucoma, O.D., chronic, simple open-angle, O.S.	Uncontrolled with pilo., eserine, Carcholin, O.S. O.D., DFP & Carcholin. Phospholine once daily, O.U.	Controlled
4	A. N.	Chronic, simple glaucoma, open-angle, O.U.	Uncontrolled with pilo., eserine, Carbomiotin. Diamox, phospholine, O.D., nightly. O.S., Carbomiotin b.i.d. then once daily	Controlled
5	A. S.	(Diabetic) aphakia, O.S., absolute glaucoma, O.S., (painful, uncontrolled)	Carcholin, b.i.d. & phospholine once daily	Controlled
6	L. H.	O.S., advanced glaucoma, narrow-angle. Iridencleisis marked field defects	Uncontrolled with Bonmiotin & Carbomiotin. Phospholine, b.i.d., & Carbomiotin, b.i.d.	Controlled symptoms
7	A. W.	Chronic, simple, open-angle glaucoma	Uncontrolled with pilo., eserine, Carbomiotin & Diamox. Started phospholine, b.i.d. O.U., & Carcholin, t.i.d., Diamox, b.i.d., controlled. Tension maintained. Now on phospholine, O.D., b.i.d.; O.S., once daily, Carcholin, b.i.d., O.U.	Controlled
8	F. P.	Glaucoma, absolute, massive intraocular hemorrhage, following iridencleisis, O.U.	Uncontrolled with pilo., eserine, Diamox, Carcholin, Humorsol	Pain controlled. Tension absolute, O.U.
9	W. M.	Open-angle glaucoma	Uncontrolled with pilo., eserine, Diamox, Carcholin. Placed on phospholine, b.i.d., Carcholin, t.i.d., Diamox, b.i.d.	Controlled
10	J. S.	Glaucoma, open-angle, O.S., diabetic	No response to pilo., eserine & Diamox. Placed on phospholine, b.i.d. & Carcholin, b.i.d.	Controlled
11	W. L.	Aphakia, glaucoma, O.U.	O.S., Floropryl nightly, O.D., phospholine nightly	Controlled
12	F. G.	Open-angle, chronic, simple glaucoma	Controlled with pilo., eserine & Carcholin, q.i.d. Placed on phospholine at night, controlled but patient complained of severe headache, nausea & vomiting. Refused to take phospholine & therefore replaced with pilo. & eserine, q.i.d.	Controlled
13	H. A.	Open-angle, chronic, simple glaucoma	Controlled with pilo. & eserine, t.i.d. Placed on phospholine & maintained q.i.d., once at night	Blurring, browache
14	E. W.	O.D., acute congestive angle-closure glaucoma, iridencleisis, controlled. O.S., uncontrolled, open-angle glaucoma	Phospholine, once at night, O.S.	Controlled
15	F. L.	Open-angle, chronic, simple glaucoma	Phospholine, q.i.d., O.U.	Controlled, some blurring

TABLE 1 (*Continued*)

Case No.	Patient	Diagnosis	Therapy	Results
16	S. C.	O.D., absolute glaucoma, blindness, quiet. O.S., chronic, simple, open-angle glaucoma	Phospholine, b.i.d., O.S.	Controlled
17	M. H.	Aphakia, O.U., glaucoma, secondary	Started with Carcholin, b.i.d., O.S. Controlled with phospholine, O.D., once daily & Carcholin O.D., once daily	Controlled
18	M. S.	Aphakic glaucoma	Started with Carcholin, b.i.d. & phospholine, b.i.d. Maintained on phospholine once q.i.d., O.U.	Controlled
19	H. F.	Chronic, simple, open-angle glaucoma	Uncontrolled with pilo., eserine, Carcholin & Diamox. Placed on Carcholin, t.i.d., O.U., & phospholine, b.i.d., O.U. Maintained on Carcholin, b.i.d., O.U., & phospholine, b.i.d., O.U.	Controlled
20	T. T.	Aphakic glaucoma	Uncontrolled with Floropryl, Daranide. Placed on phospholine, b.i.d., Carcholin, t.i.d., Daranide once daily. Maintained on phospholine, q.d., night	Controlled
21	M. R.	Chronic, simple, open-angle glaucoma	Uncontrolled with pilo., eserine, Carcholin & phospholine. Iridencleisis, controlled for some time when tension increased & placed on phospholine, b.i.d., O.S. & Diamox, b.i.d.	Controlled
22	E. S.	Diabetic, glaucoma, aphakia, O.U. Cyclodialysis, O.D.	Phospholine, b.i.d., & Carbomiotin, b.i.d.	Controlled
23	N. L.	Chronic, simple glaucoma, O.U.	Phospholine nightly	Controlled
24	J. N.	Chronic, simple glaucoma, open-angle glaucoma, O.U.	Phospholine, b.i.d., O.U., & Carcholin, b.i.d., O.U.	O.D. uncontrolled & needed iridencleisis, O.S., controlled
25	J. W.	Aphakia (choroidal detachment). Prolapsed iris, required repair, O.S.	Phospholine, b.i.d. & Carcholin, b.i.d.	Controlled
26	S. S.	Chronic, simple, open-angle glaucoma, O.S.	Pilo. & eserine, t.i.d., & phospholine 0.125 percent, nightly	Controlled
27	E. H.	O.D., aphakia, glaucoma O.S., chronic, simple glaucoma	Controlled with pilo. & eserine, b.i.d. Placed on 0.125 percent phospholine nightly, O.U., then every other night	Controlled
28	S. E.	Chronic, simple, open-angle glaucoma, O.D.	Controlled with pilo. & eserine. Placed on phospholine 0.125 percent nightly	Controlled
29	H. F.	Chronic, simple glaucoma, O.U., open-angle	Not controlled with pilo. eserine & Diamox. Placed on phospholine 0.125 percent, b.i.d., O.U., Carbomiotin, b.i.d., O.U., & Diamox, b.i.d.	Controlled
30	M. B.	Chronic, simple glaucoma, open-angle, O.S.	Not well controlled with usual Rx. Placed on phospholine 0.125 percent nightly & Diamox, b.i.d.	Controlled
31	C. H.	Chronic, simple glaucoma, open-angle, O.U.	Controlled with pilo., eserine & Carcholin, t.i.d. Placed on phospholine 0.125 percent once daily, O.U., & Carbomiotin, O.U.	Controlled, blurriness

TABLE 1 (*Continued*)

Case No.	Patient	Diagnosis	Therapy	Results
32	A. L.	Chronic, simple glaucoma, open-angle, O.U.	Phospholine 0.125 percent nightly, O.U.	Controlled
33	J. S.	Chronic, simple glaucoma, O.S., Diabetic retinitis	Carcholin, b.i.d., O.S., & Phospholine b.i.d., O.S.	Controlled
34	A. D.	Chronic, simple glaucoma, O.U., mature cataract, O.S.	O.D. controlled with phospholine, q.i.d., O.U. Carbomiotin once daily, O.U., & Daranide once	O.D. was controlled with medications and iridencleisis. O.S. controlled with medications, iridencleisis followed by cataract extraction

Daranide. Many mild glaucomas may be controlled by instilling 0.125-percent phospholine iodide before retiring or every other night. The only complaints following use of phospholine has been blurring of vision, due to the cyclotonia (miosis), and supraorbital headache. With continued use of this drug these complaints gradually become less.

225 West State Street (8).

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A CASE OF UNILATERAL DEGENERATIVE ANOPHTHALMIA*

JOHN H. WARFEL, PH.D.
Buffalo, New York

Introduction

When studying the sequence of events which constitute the embryology of the human body, the biologist becomes keenly aware of the fact that normal development proceeds along a very narrow pathway. Deviation from this pathway results in the myriad abnormalities which can involve each organ system of the body, including the organs of special sense. With respect to the eye, one of the more rare abnormalities in man is the condition of anophthalmia.

Presentation of this unusual condition is best begun by quoting a paragraph from Mann[2] (1957) who states:

> It appears logical to begin a description of abnormalities of the eye with a discussion of the possibility that the eye may entirely fail to develop. This raises the question of exactly what is meant by "the eye" in this sense. To the embryologist the eye proper means those structures (retina, pigment

* From the Department of Anatomy, University of Buffalo School of Medicine.

epithelium, and fibers of optic nerve) which arise from the neural ectoderm of the optic outgrowth. To the anatomist the term also includes the mesodermal elements which develop in connection with this (choroid, sclera, nerve sheath, vessels). Now the clinical definition of anophthalmia is a condition in which no eyeball, however small, can be found in the orbit. In life there is great practical difficulty in distinguishing between a true anophthalmia and an extreme degree of microphthalmia. It is usually only possible to settle the matter by microscopic examination of serial sections of the orbital contents, which is not often possible. Clinically, the question is of little importance but the theoretical aspects of the subject are of great interest.

Anophthalmia may result from several different developmental aberrations. One of these is a failure of the optic pit to deepen and form an optic outgrowth from the forebrain; this is primary anophthalmia. Another aberration results in eye absence as a consequence of suppression or abnormality of the forebrain; this is secondary anophthalmia and is only one of many related defects occurring simultaneously. A third type of anophthalmia, known as consecutive or degenerative anophthalmia, occurs in which the optic vesicle formed in the normal manner but subsequently degenerated. This appears to be the situation in the case which is presented here.

Case report

The condition of right-sided anophthalmia was discovered in the cadaver of an 80-year-old white woman in the gross anatomy laboratory during routine class dissection by freshman dental students. The records of the infirmary from which the body was obtained indicated that this individual was one of low IQ, mildly hypertensive, with one eye congenitally absent and ulceration in the other eye. The cause of death was given as a cerebrovascular accident, (Dahmer[1]).

Removal of the brain, prior to dissection of the orbit, had disclosed the absence of the right optic nerve. The chiasm was formed by the left nerve and right and left optic tracts (fig. 1). The roof of the right bony orbit, as seen from the anterior cranial fossa, was observed to be much flatter than the left and

Fig. 1 (Warfel). Inferior surface of the brain in the region of the optic chiasma. Arrow points to the left optic nerve.

the optic foramen was reduced to a slitlike aperture transmitting only the ophthalmic artery (fig. 2).

The superior part of the bony orbit was carefully dissected away and a one-inch section of the supraorbital margin (including the supraorbital foramen) and frontal bone was sawed out, through which opening the entire orbital contents were removed intact. A careful gross examination of this revealed that most of the structures normally found within the orbit were present. These included: the ophthalmic nerve and its three branches (frontal, lacrimal and nasociliary), all the extrinsic eye muscles including the levator palpebrae superioris, and the trochlear, abducens, and branches of the oculomotor nerves to these muscles.

The ophthalmic artery and its branches were present (with the exception of the central artery of the retina) as well as an ophthalmic vein which was noted to be exceptionally large. The eyeball and its associated optic nerve were completely absent. In their place was a fibrous cord which ran from the point of origin of the extrinsic muscles at the apex to the area where the eyeball should

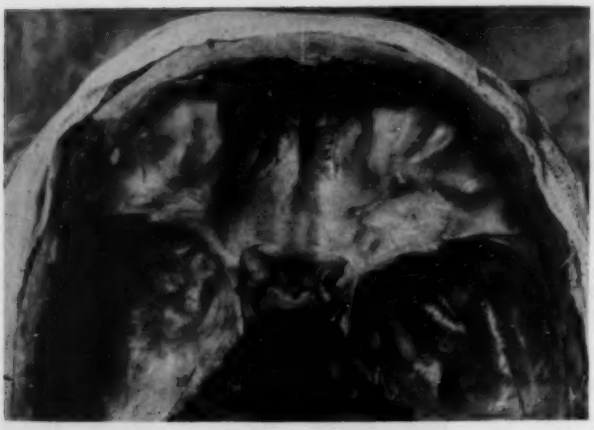

Fig. 2 (Warfel). Anterior and middle cranial fossae. In the absence of the right optic nerve, the ophthalmic artery can be seen as it branches from the right internal carotid artery.

be found. At the end of this cord was a slight bulbous swelling to which the extrinsic muscles attached. This region of the orbital contents presented the appearance of a solid mass of connective tissue which extended anteriorly and attached to the eyelids.

Gross examination failed to reveal the presence of a ciliary ganglion or the lacrimal gland. Absence of the gland is of interest because in previously reported cases the gland was not only present but found to be larger than usual.

After the specimen had been studied grossly it was embedded in celloidin, serially sectioned, stained and mounted on 2.0 by 3.0-inch slides, by the usual methods, for microscopic examination. From the series several of the sections which passed through the connective tissue mass previously described were selected for detailed study under the microscope.

Within the dense tissue area containing the bulbous structure at the end of the fibrous cord, mentioned earlier, could be seen a circular space of about one-mm. diameter having a well-defined margin, and in which was found an opaque mass of about 0.75-mm. diameter. Under high power (fig. 3), the space is seen to be bounded by concentric layers of dense connective tissue similar to the sclera of the eyeball which, at the periphery, blend with the surrounding irregular connective tissue fibers. The somewhat spherical, opaque mass in the center shows little cytologic detail but is suggestive of a lenslike structure.

It would appear that in this central area is an embryonic eye which, for reasons unknown, was arrested in its development. Apparently the mesodermal components responsible for the outer fibrous layer of the eyeball, the sclera, operated normally up to this time. If the inner, vascular, choroid layer, which usually develops with the sclera, is present it cannot be distinguished. The pres-

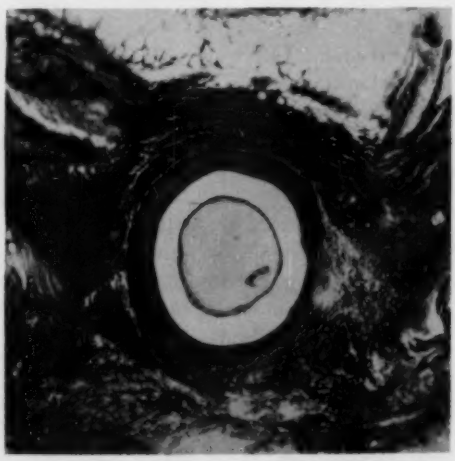

Fig. 3 (Warfel). Photomicrograph of eyelike structure, showing the centrally contained "lens."

ence of the lenslike structure in the center would indicate that invagination of the surface ectoderm had taken place and, in turn, that the stimulus for this process, the contact by the optic vesicle growing out to meet the surface ectoderm from the forebrain, had also been initiated. Growth continued until the optic cup deepened and surrounded the invaginating surface ectoderm until the lens was formed and enclosed within the sclera. The structures which normally arise from the neural ectoderm (retina, ciliary epithelium, iris and pupillary muscles, and optic nerve)are not to be found. The possibilities exist that either these structures failed to develop at all or that development proceeded to a certain stage and then some degenerative process occurred.

SUMMARY

1. Congenital absence of the right eye was discovered in an 80-year-old female cadaver during routine class dissection.

2. Gross examination of the orbital contents disclosed the presence of the normal components with the exception of the eyeball and optic nerve, and the lacrimal gland.

3. The case presented here seems to be one of consecutive or degenerative anophthalmia, on the basis of the microscopic examination which revealed the presence of a minute, eyelike structure which enclosed a "lens." This suggests that normal eye development proceeded to a certain stage and then some degenerative process manifested itself, arresting further development.

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SYNDROME OF FISHER*

OPHTHALMOPLEGIA, ATAXIA AND AREFLEXIA

EDWARD A. HYNES, CAPT. (MC) U.S.N.
Chelsea, Massachusetts

Three cases of neuropathy characterized by ophthalmoplegia, ataxia and areflexia were reported by Fisher[1] (1956). The one patient whose spinal fluid was examined had a high protein content with relatively low cell count whose spinal fluid was examined had a high protein content with relatively low cell count late in her illness. This disassociation is characteristic of so-called infectious polyneuritis (the Guillian-Barre syndrome). Symmetrical ophthalmoplegias may occur with polyneuritis but usually only in association with widespread peripheral paralysis. When this is the case, diagnosis is not too difficult. When, however, multiple ophthalmoplegias occur without peripheral signs suggesting polyneuritis, diagnostic difficulties arise. If no specific etiology can be demonstrated to explain such a neuropathy, a series of cases showing this triad of neurologic signs might suggest a new disease. Fisher concluded that the syndrome of ophthalmoplegia, ataxia and areflexia represented an unusual variant of acute idiopathic polyneuritis and need not be considered a separate entity.

Two similar cases were reported by Smith and Walsh[2] (1957). Noting that all of the cases had occurred in males, they summarized the essential features of the syndrome as exemplified by the five reported cases:

(1) Involves males between 38 and 63 years of age, (2) antecedent respiratory infection, (3) external ophthalmoplegia, (4) retention of pupillary reflexes, (5) diplopia, (6) facial paralysis—bilateral in two cases,

* The opinions or assertions contained herein are the private ones of the author and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.

(7) cerebellar ataxia, (8) generalized areflexia, (9) migratory paresthesias, (10) minimal sensory impairment, (11) absence of mental changes, (12) absence of generalized or peripheral motor weakness, (13) albuminocytologic dissociation—late, and (14) recovery without specified treatment in seven to 12 weeks.

In commenting on these features, it must be pointed out that two of Fisher's cases showed internal as well as external ophthalmoplegia, but that the internal was less complete. The syndrome is not accompanied by fever; most of the features develop during the first 10 days, and all early laboratory findings remain essentially normal. None of the cases have shown ophthalmoscopic changes or visual field defects, although papilledema has been reported in the Guillian-Barre syndrome.[8]

An example of this syndrome in a woman, apparently the first to be reported, is made more interesting because the condition was considered to be botulism during its early phases.

Case report

I. F. W. (258-276), a 46-year-old white Army nurse with 17 years of active military duty was stationed in Iran. She had been well until the onset of the present illness. She had received prophylactic influenza vaccination 10 days previously, and had eaten home-cooked meat that tasted as though it might have been "tainted" on the evening before her illness began. Her diet had been adequate and her use of alcohol infrequent.

Following a good night's sleep, she experienced dizziness, ataxia and diplopia upon arising. She was immediately hospitalized. During the following 24 hours she developed occipital headaches, nuchal pain, slurring speech, difficulty in swallowing, photophobia and perioral paresthesias.

Initial examination showed inability to abduct or elevate the eyes. Downward gaze and convergence were preserved. Accommodation was normal, the visual fields were full, and the ophthalmoscopic examination showed normal fundi. Her gait was ataxic and her co-ordination poor. Twenty-four hours later, bilateral ptosis of the lids had developed, accommodation and convergence abilities had disappeared, the palate was deviated to the right, and the tongue to the left. There was a bilateral facial weakness, increased difficulty in swallowing, and a sense of anxiety. The deep tendon reflexes were reported equal and questionably hyperactive but there was no ankle clonus or loss of strength in her extremities. Blood cytology, chemistry and urinalysis were normal. The spinal fluid was clear and colorless, the cell count zero, the total protein 42.7 mg. percent, and the opening pressure 70 mm. H_2O. A prostigmine test was considered negative. The accumulation of saliva in her throat and consequent choking necessitated a tracheostomy.

The patient was placed in a respirator, and transferred to a base hospital by plane. Forty-eight hours after onset, examination showed:

"Pupils dilated and react poorly to light. There is complete absence of extraocular movement and complete bilateral ptosis. The facial muscles are weak bilaterally, and the patient is unable to wrinkle her forehead. The masseters are weak and the jaw sags. All reflexes are present and are of normal intensity. Hemograms, sedimentation rate, blood chemistries, chest and skull films are normal. Spinal fluid examination shows zero cell count, total protein and fluid dynamics normal."

A therapeutic trial with prostigmine (2.0 mg. every four hours) failed to improve any of the paralyses.

On the fifth day of the illness, the patient was transferred in a respirator by plane to a large general military hospital in Germany for further diagnosis and treatment. Examination there, on the seventh day of the illness, showed that the patient was stuporous, unresponsive to commands, breathing shallowly, and in respiratory distress. The ocular signs were unchanged except that the pupils were dilated and no longer responded to light. Bilateral paralysis of the 3rd, 4th, 6th, 7th, 9th, 10th, 11th and 12th nerves was noted on neurologic examination, and the abdominal, as well as the deep tendon, reflexes were absent. There were no pathologic reflexes and no paralyses of the extremities.

Extensive laboratory studies were normal except as they reflected moderate dehydration. The spinal fluid pressure, fluid dynamics, protein, sugar and serology were normal. Under general supportive care, utilizing the respirator and gavage, later a rocking bed, the patient slowly improved, and seven weeks after the onset of her illness was considered well enough to be returned to the United States.

After admission to a United States Naval Hospital, the patient continued to improve but still had numerous neurologic deficits. Ophthalmologic examination showed incomplete bilateral ptosis, greater on the left. Both pupils were semidilated, the left wider than the right, and both responded to light, though sluggishly and through a small amplitude. Both lateral recti were paretic and diplopia caused the patient to keep her left eye closed. The left eye was hypertropic and, when adducted, could not look down fully. Small convergence movements were possible. Accommodation appeared normal for age. There was bilateral facial weakness, but the eyes elevated and converged with attempted closure of the lids. Phonation was still poor, but the motility of the vocal cords appeared symmetrical and full. A weak gag reflex was present but the ability to swallow had not returned, and feeding was still by tube. There were paresthesias

around the mouth and wrists. The deep tendon reflexes were generally depressed. The gait was unsteady and co-ordination was poor. Finger to nose and associated movement tests were performed poorly. The strength of the extremities was not inconsistent with that expected after a long illness; there was residual weakness of the muscles supplied by the spinal accessory nerve.

A full battery of laboratory tests on the blood showed no significant abnormalities. Urinalysis showed a mild pyuria. The spinal fluid showed five polymorphonuclear leukocytes and total protein of 159 mg. percent. Pulmonary function studies gave results within the low normal range and the electroencephalogram produced no abnormal findings.

Summary of course of illness. After sudden, afebrile onset of ataxia and diplopia, the first seven days saw progressive involvement of numerous cranial nerves. Pooling of oral secretions embarrassed respiration during the first 36 hours and the ophthalmoplegia rapidly became total. The abdominal, as well as the deep tendon reflexes, were lost by the seventh day. Ability to co-ordinate movements was lost early and persisted. General improvement commenced on the 11th day, and on the 16th day respiratory support was no longer needed. Improvement was thereafter gradual but constant. Swallowing ability returned sufficiently to permit normal feeding on the 50th day and, on this day for the first time, the spinal fluid protein was found to be elevated (159 mg. percent) with low cell count (five polymorphonuclear cells).

At this time the patient was able to walk without assistance and, while the gait was unsteady, it was no longer considered definitely ataxic. Co-ordination improved but finger to nose and associated movements tests were still inaccurate. Phonation improved more slowly but, when the patient was permitted to go home for the Christmas holidays, on the 64th day of illness, her speech could be understood, and she had only occasional diplopia. On the 85th day, excursions of the extraocular muscles were full and symmetrical and the patient reported that she had been free of diplopia for a week. There was no longer ptosis and the levator action seemed full. The facial diplegia had recovered and there was no lagophthalmos. Low amplitudes of fusional abilities had been re-established. The patient was followed thereafter as an out-patient, and her course to date, 20 weeks after onset, has been neurologically uncomplicated.

Record of diagnostic impressions during course of disease. On the original hospital admission three diagnoses were entertained. A postvaccination (influenza) encephalomyelitis was considered but the clear sensorium, normal spinal fluid and lack of fever did not support this. Acute myasthenia gravis was considered but thought unlikely in view of the failure of prostigmine to alter the ocular, masseter and pharnygeal weakness. The possibility of the beginning of an outbreak of botulism, with this as the first case, was feared and, when no antiserum could be obtained, rapid evacuation of the patient to a less remote hospital was considered imperative. On arrival at the base hospital, the diagnosis of acute myasthenia gravis was considered most likely despite the previous negative prostigmine test. When the patient failed to show consistent improvement on full dosage of prostigmine, some type of toxic neuropathy was considered the most probable diagnosis, and the exotoxin of botulism was considered to be the most likely neurotoxin.

Culture and bacteriologic examination of the food taken from the patient's refrigerator, including a sample of the suspected meat, failed to show clostridia and extracts prepared from this food were not toxic to mice. Later, mouse protection studies, using the patient's convalescent serum, failed to support the diagnosis of botulism. No other cases of botulism occurred in the area where the illness started and it became apparent that this etiology was not the cause of neuropathy. The patient was returned to the United States with the diagnosis of a neuropathy due to an unidentified neurotoxin.

Treatment during illness. From the outset, treatment was nonspecific, and was confined to supportive measures and heavy vitamin dosage by parenteral and oral routes. The trial with prostigmine as treatment was abandoned when it proved ineffective. Tracheostomy, the respirator, rocking bed, intravenous feeding and gavage were used in support.

Comment

This is apparently the sixth reported example of Fisher's syndrome and the first case reported in a female. As in the other cases, this was an afebrile cranial nerve neuropathy with symmetrical ophthalmoplegia (complete in this instance), ataxia, areflexia and a late rise in spinal fluid protein without an increase in spinal fluid cells. It was not

associated with peripheral paralysis such as is seen when ophthalmoplegias occur in the Guillian-Barre type of polyneuritis. Recovery occurred without specific treatment in about 12 weeks.

The fact that this seems to be the first case of Fisher's syndrome reported in a female is of interest and establishes that the neuropathy is not confined to males as previously suggested. There is no record of an antecedent respiratory infection in this case and the illness appears to have been more prostrating than in those previously reported. It is otherwise similar in all of its features.

The likelihood of confusing the early signs and symptoms of this syndrome with acute myasthenia gravis and botulism was mentioned by both Fisher and Smith and Walsh, and such problems arising in the differential diagnosis are illustrated in this case. Confusion with Wernicke's encephalitis during the period of stupor and confusion was made unlikely by the excellent dietary and social background of the patient.

While military personnel serving in foreign assignments are protected by vaccination from diphtheria, this diagnosis must be considered in cranial nerve neuropathies and the more unusual forms such as nasal and wound diphtheria should be remembered. Modern agricultural practices have introduced several fluorophosphorate and other neurotoxic insecticides and fungicides that will probably grow in importance as etiologic possibilities in toxic neuropathies.

Summary

Another example of the syndrome of ophthalmoplegia, ataxia and areflexia has been presented. This appears to be the first reported case of Fisher's Syndrome in a female. Except for the difference in sex, it is similar to the previous five cases reported.

U.S. Naval Hospital.

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GROENBLAD-STRANDBERG SYNDROME*

Report of two cases in which macular degeneration occurred before angioid streaks

Selahattin Erbakan, M.D.
Izmir, Turkey

Doyne was the first to publish (1889) a case in which he observed irregular and numerous pigmented streaks around the optic disc in the fundi of both eyes. Later, (1891) Plange and (1892) Knapp published cases of angioid streaks. In 1896, Darier reported cases of pseudoxanthoma elasticum characterized by the softening and thickening, and yellowish color of the skin. In 1929 Groenblad examined three cases of angioid streaks and pseudoxanthoma elasticum, two also being examined by Strandberg in the dermatology clinic. These reports demonstrated that angioid streaks may be a local sign of a systemic disease.[1]

About 150 cases of Groenblad-Strandberg syndrome had been published up to 1950. They are usually bilateral, though the fundus findings may be different in each eye. Fuchs[2] has mentioned one unilateral case.

Bisher[3] has seen three cases of Groenblad-Strandberg syndrome with scattered dustlike pigmentation and whitish-yellow and gray-brown spots in the fundus. He has termed this as speckled fundus.

* From the Eye Clinic of the Medical Faculty, University of Ege.

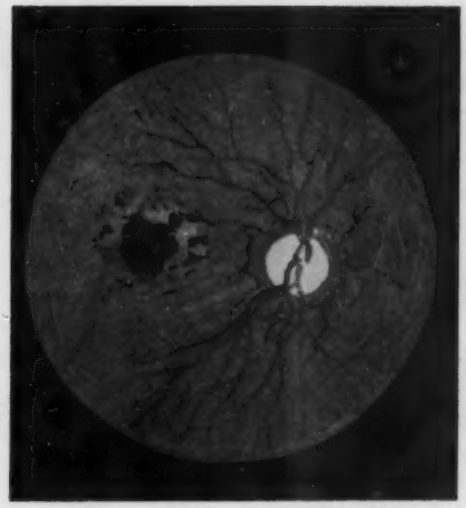

Fig. 1 (Erbakan). Fundus drawing, right eye, Case 2.

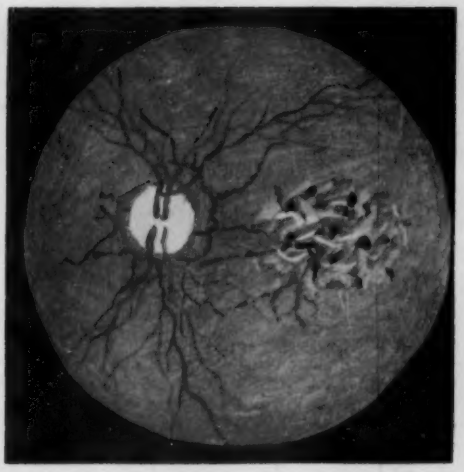

Fig. 2 (Erbakan). Fundus drawing, left eye, Case 2.

McWilliam[4] differentiates between secondary angioid streaks which produce local changes in the eyeball, and the systemic form.

Yatzkan[5] explains that systemic elastic tissue degeneration (Paget's disease) is often associated with angioid streaks as well as systemic arterial disease. Voisin and Lombard[6] published a case of macular degeneration and pseudoxanthoma elasticum without angioid streaks.

Case reports

Case 1

Mrs. L. T., aged 50 years, a house wife, came to our out-patient department with haziness of vision in the left eye continuing for three years. Three years earlier she was examined and treated in a university clinic with the complaint of a sudden blurring of vision. It was ascribed to a macular hemorrhage due to high arterial pressure. She benefited little from the treatment.

Eye examination. In both fundi, irregular, dark-brown, pigmented streaks formed a ring around the optic discs. Some lines of pigment extended from this ring to the equator. The macular region in the left eye was of a degenerated gray color and a small plaque of retinitis proliferans was seen. The vision was 7/10 in the right eye and finger counting at four meters, temporally, in the left.

Physical examination. The skin of the under arm, neck and abdomen showed typical pseudoxanthoma elasticum. Arterial pressure was 220 mm. Hg. Clinical and laboratory examinations revealed no pathologic finding.

During the three years the patient was treated in a clinic, no angioid streaks were found.

Case 2

Mr. I. V., aged 45 years, a grocer, on August 11, 1958, while reading the newspaper, felt a sudden decrease in vision. He underwent treatment elsewhere and was not seen in our out-patient department until November 1, 1958.

Eye examination. Externally both eyes were normal. There was a gray degeneration and small pigmented patches in the maculas of both eyes, especially marked in the left macula where there were large choroidal vessels and scattered sclerotic white arteries. In the right macula there was a small hemorrhagic plaque.

Clinical and laboratory examinations revealed

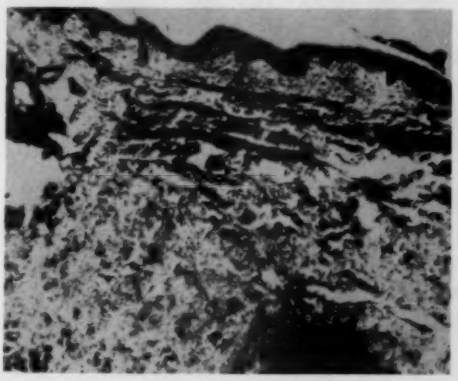

Fig. 3 (Erbakan). Section of skin biopsy, Case 2.

chronic infection of the tonsils; tonsillectomy was performed. The Mantoux reaction was positive and sedimentation was 35 mm. in half an hour, 63 mm. in an hour and 91 mm. in two hours.

The disease was diagnosed as a central choroiditis and a specific therapy was started. He was released on November 19, 1958.

At follow-up examination on August 1, 1959, typical angioid streaks were seen (figs. 1 and 2). On the skin of the neck, underarm and in both inguinal regions, pseudoxanthoma elasticum was seen. Biopsy of the skin was taken (fig. 3). The skeletal X-ray examination showed no signs of Paget's disease. Electrocardiograms were normal. The oscillometric findings for both femoral arteries were also normal. Arterial pressure was 140/80 mm. Hg; cholesterin in the blood was 1.70 gr. per liter. Other examinations revealed no pathologic signs.

In this case the angioid streaks occurred after the macular lesion. Therapy as for a central choroiditis was instituted.

Comments

1. In both cases angioid streaks were associated with pseudoxanthoma elasticum and were seen after the macular degeneration. Many patients consult a physician for macular degeneration; in some of these cases angioid streaks will probably appear after a time.

2. In a case of pseudoxanthoma elasticum and macular degeneration without angioid streaks (Voisin and Lombard[6]), if the patients had been observed for a longer period, angioid streaks might have appeared in the clinical picture.

3. In the macular degeneration with or without hemorrhages seen in the 40 to 50-years group, angioid streaks may appear after a time. These patients, whether or not degenerative changes in the general elastic tissue are present, must be examined at routine follow-up visits.

Eye Clinic,
Ege University Medical School.

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CONJUNCTIVAL GRANULOMA DUE TO AN IMBEDDED CILIUM*

Robert D. Kiesel, M.D.
Ann Arbor, Michigan

In the ophthalmic literature there are numerous case reports and studies on intraocular cilia and their pathologic significance. Cilia, usually as a result of injury, have become imbedded in cornea, lens tissue, sclera and the anterior segment of the globe.[1,2] They have also been reported in the lacrimal punctum. However, during the past 30 years, only two cases in which cilia were imbedded in conjunctival tissue have been reported. The following is a brief study of a conjunctival granuloma due to an imbedded cilium.

* From the Department of Ophthalmology, University of Michigan Medical Center.

Case History

On May 9, 1960, a 46-year-old white man was referred to the Ophthalmology Clinic for evaluation of a small growth on his right eye. The patient complained only of undue redness of his right eye for several weeks. There was no history of any ocular injury or irritation.

Visual acuity with correction was 20/20, O.U. Near vision with correction was J0, O.U. Pupillary reactions were normal. Extraocular movements were full. There was no tropia under cover examination. Dilated funduscopic examination was normal, O.U. The lids and lacrimal apparatus were normal. The palpebral and bulbar conjunctiva were normal, O.S.

On the bulbar conjunctiva of the right eye, approximately five mm. from the temporal limbus was an elevated lesion measuring 4.0 by 3.0 by 3.0 mm. The mass appeared slightly yellow, was solid in consistency and was not bound down to the under-

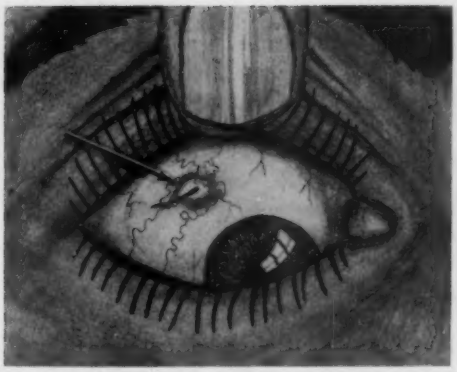

Fig. 1 (Kiesel). Drawing of imbedded cilium, showing granuloma.

lying sclera. Radially, both superficial and deep vessels were seen extending from the lesion, while the remaining bulbar conjunctiva appeared normal. On closer observation, underneath the folds of the conjunctiva and extending into the lateral aspect of the growth, a cilium was seen. These findings were then verified by careful slitlamp examination. The cilium was entirely imbedded in the substance of the conjunctiva and could not be removed. Figure 1 represents a drawing of what was seen clinically.

For surgical removal topical 0.5-percent pontocaine was instilled into the right eye and approximately 0.5 cc. of 2.0-percent Xylocaine and adrenalin was injected subconjunctivally beneath the lesion. A horizontal elliptical excisio nof the entire growth containing the cilium was than performed and the conjunctival edges approximated with a running 6-0 catgut suture. Neosporin ointment was instilled and the eye padded for three days. Follow-up one week later revealed excellent healing.

The lesion was fixed in formalin immediately after its removal. Histologic examination of the flat paraffin sections of the lesion revealed:

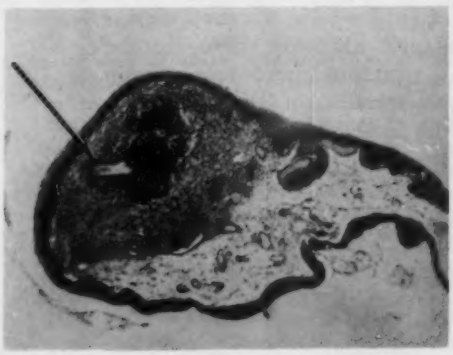

Fig. 2 (Kiesel). Low-power magnification, showing the granuloma (a) and the hair root (arrow).

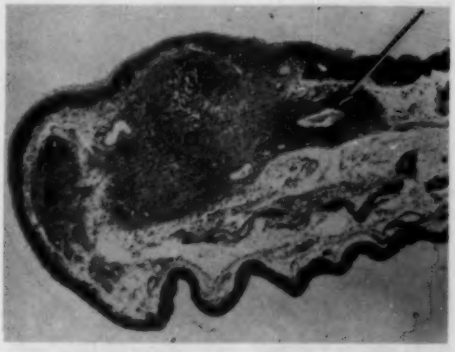

Fig. 3 (Kiesel). Higher magnification of lesion, showing shaft of cilium (b) demonstrates an area of elastosis.

Histology

The conjunctival epithelium covering the nodular lesion is continuous and of normal structure (figs. 1 and 2). Transitional sections through a hair were seen (figs. 2, 3, and 4). An extensive nodular inflammatory reaction was found around the hair. This was composed of lymphocytes, histiocytes, a few polymorphonuclear leukocytes, fibroblasts and new-formed blood vessels (fig. 4). In one area next to the hair a rather dense accumulation of histiocytes with round and large cell bodies was observed (fig. 5). Next to the reaction around the hair there was an area of subepithelial elastosis (fig. 3) re-

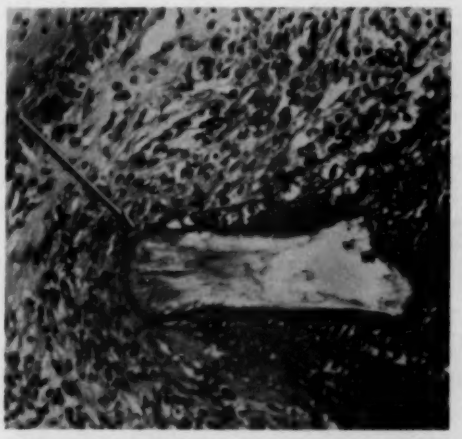

Fig. 4 (Kiesel). High magnification, showing granuloma and (arrow) hair root.

Fig. 5 (Kiesel). High magnification of lesion (a), showing the histiocytic reaction.

sembling an early pinguecula. The histologic impression was that of a nodular reaction to a cilium which was completely and deeply imbedded in the conjunctiva.

Comments

Smith,[3] in 1936, described a similar clinical and pathologic case that was, however, due to a piece of exploding coke. Espino[4] has reported the second case occurring in a child and probably due to forceps delivery.

The case reported herein emphasizes the importance of careful examination of epibulbar growths and their differentiation from the common finding of pingueculae in this area. Complete surgical excision of these lesions is usually a simple office procedure and permits pathologic examination.

University Medical Center.

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Ophthalmic Miniature

The eyeball, when removed, presented nothing unusual externally, but on looking at the section of the optic nerve itself, I observed a small black spot. Having scraped this spot, and placed the result under the microscope, nucleated cells, loaded with pigment exactly like those of melanosis, were seen. On cutting open the eyeball, a rounded growth of melanosis, the size of half a cherry, was found just above the optic disc, between the choroid and retina. It involved the optic disc itself. It was clear, from the condition of the optic nerve where cut across, that the portion left behind was also diseased. I, therefore, placed the man again under chloroform, and with some difficulty succeeded in excising a further portion of the nerve trunk half an inch in length. On examining this portion I found that it was quite healthy where cut across, and that the melanosis extended only about a line in depth from its distal end.

J. Hutchinson,
"Cancer within the eyeball,"
Royal London Ophth. Hosp. Reports, **5**:90, 1866.

OPHTHALMIC RESEARCH

EDITED BY FRANK W. NEWELL, M.D.
950 East 59th Street, *Chicago 37, Illinois*

Abstracts of papers presented at the meeting of the East-Central Section of the Association for Research in Ophthalmology, Inc., Ohio Union Conference Theater, Columbus, Ohio, January 2 and 3, 1961.

The influence of miosis and mydriasis on the rate of resorption of red blood cells. H. Bredemeyer, M.D., Department of Ophthalmology and Institute for Research in Vision, The Ohio State University.

Equal amounts of red cells tagged with $Na_2Cr^{51}O_4$ were injected into the anterior chambers of the eyes of albino rabbits. A miotic was then instilled into one eye, while the other one received a mydriatic. Twenty to 28 hours later the eyes were enucleated and the Cr^{51} content determined. It was found that without exception the miotic eyes showed a much higher rate of resorption.

The contribution of electron microscopy to the problem of diabetic retinopathy. J. M. B. Bloodworth, Jr., M.D., Department of Pathology, The Ohio State University.

A study of the anatomy of the retinal capillary wall in human and animal eyes was undertaken in order to evaluate the local factors responsible for the retinal microaneurysms in diabetes. The human retinal capillary consists of a basement membrane which is often split into many compartments. Within the basement membrane is a lining of endothelial cells surrounding the lumen. Within the split basement membrane are found perithelial cells. When compared to the animal eye, the basement membrane shows many more divisions. In the diabetic capillary there is a deposition of proteinaceous material on the basement membrane.

The behavior of tumor cells from Walker carcinosarcoma 256 in the ocular tissues of rats. P. K. Basu, M.B., T. M. Sibay, M.D. and S. C. Chang, M.D., Departments of Ophthalmology and Pathology, University of Toronto.

The object of the study was to see if new growth could be produced in the ocular tissues with intraocular, intraorbital and intramuscular injections of cell suspension from Walker carcinosarcoma of rats.

It was observed that tumor cells could produce new growths in the eye and orbit when injected directly into these structures. However, intramuscular injections of a suspension of tumor cells failed to give rise to any growth in the eye or in the obital tissues. Following intramuscular injections, cancer cells could be detected in the blood stream of some animals but not in the ocular tissues.

The use of jaundiced eyes as sources of donor material. R. R. Toews, M.D., and P. K. Basu, M.B., Department of Ophthalmology, University of Toronto.

A study was made of the bilirubin concentration of the vitreous and aqueous of a number of jaundiced human and rabbit eyes. It was found that even with a very high serum level the vitreous and aqueous levels remained below 0.5 percent of total bilirubin. It was concluded that a blood-aqueous and blood-vitreous barrier to bilirubin must be present in human and rabbit eyes. The suggestion is made that the yellow discoloration of jaundiced vitreous should not necessarily exclude it from use for vitreous implantation.

A method for equalizing the objective and subjective angles in strabismic individuals. Samuel C. McLaughlin, Jr., M.S., Ann Arbor, Michigan.

When an individual with strabismus is aware of diplopia, the image associated with the fixating eye is correctly localized and the image from the deviated eye is incorrectly localized. If the fixating eye is then covered, correct localization of the image associated with the formerly deviated eye can be established. In this procedure, the image associated with the eye which was deviated at the start of the procedure undergoes a change in apparent position. If the individual can be taught to perceive this change in position as an actual movement of the image, the subjective angle of strabismus becomes equal to the objective angle. The correlation between these two phenomena was demonstrated experimentally in 76 subjects.

Clinical evaluation of local ocular anticholinesterase agents in myasthenia gravis. Conrad L. Giles, M.D. and Martha R. Westerberg, M.D., Departments of Ophthalmology and Neurology, The University of Michigan Medical School.

Ten myasthenia gravis patients seen in the University of Michigan Medical Center between November, 1959, and March, 1960, were treated

with local ophthalmic application of anticholinesterase drugs. Five patients demonstrated subjective and objective improvements of their ocular myasthenic sign and symptoms. Two patients showed improvement with therapy, but were unable to tolerate the drugs; two patients neither improved nor tolerated the treatment, and one tolerated the medications but showed little improvement.

Influence of pyrogen and of ACTH on healing of corneal ulcers in guinea pigs. P. U. Fechner, M.D. University of Michigan.

Standard thermal injuries were produced in three groups of guinea pigs. One group was treated with injections of a bacterial pyrogen and one with ACTH. The third group served as a control.

In the ACTH- and pyrogen-treated groups, there was less corneal edema and the number of intracorneal abscesses was smaller than in the control group. Healing, however, was delayed by ACTH, while accelerated by the pyrogen. In our opinion, fever therapy cannot be completely supplanted by direct administration of ACTH or corticosteroids.

A follow-up study of the 809 children in the Kanawha County public school. Edwin M. Shepherd, M.D., Charleston, West Virginia.

A study of 809 school children from the fourth, fifth and sixth grades of 10 schools in Kanawha County, West Virginia, was made in 1954. The significance of reverse reading in the so-called normal child was evaluated at those levels. A follow-up study of these same children was made three to five years later. A predictable performance in mathematics and English can be shown to be based on the reverse patterns demonstrated by simple free-hand drawings made at the lower level. The high order of significance of this predictability leads to two conclusions: (1) that reverse reading is probably a manifestation of a dominance pattern; (2) that this pattern works so strongly in influencing the child's scholastic achievement it merits a more uniform and universal application in the evaluation of all students. Until the educators have worked out a reasonable and reliable approach to this problem, ophthalmologists will need to be alert to its significance not only to the poor reader but also the indifferent students whom they know to be of a high order of intelligence.

The relationship of steroid therapy and cataracts in patients with rheumatoid arthritis. S. B. Pfahl, M.D., T. A. Makley, M.D., F. W. McCoy, and N. O. Rothermich, M.D., Departments of Ophthalmology and Medicine, The Ohio State University, School of Medicine.

A series of 40 patients with rheumatoid arthritis who had been treated for varying periods with steroid were examined for posterior subcapsular cataracts. Two (five percent) of the 40 patients showed posterior subcapsular opacities. These patients had received moderate or high doses of steroids. This report does not substantiate a recent report by Black, et al., who reported an incidence of 17 in 44 patients (39 percent).

Bacteriophage typing of ocular strains of staphylococci: A preliminary report. T. Suie, Ph.D., M. Blatt, B.Sc., S. Sroufe, Ph.D., and D. Gracy, M.Sc., The Ohio State University School of Medicine.

In 312 consecutive isolations of staphylococcus from patients with external eye infections, 31 percent were coagulase positive and, therefore, were potentially typable. Fifty-eight of these strains were typable. No epidemic phage pattern could be established. The majority of strains were lysed by more than one phage type. These preliminary studies have shown that 54 percent of phage strains 80 and 81, the so-called "hospital hot strains" were resistant to penicillin, while 71 percent of the strains containing type 83 in their pattern were resistant to this antibiotic. Generally, the nontypable staphylococci were more resistant to the "cyline" drugs and streptomycin than the typable ones. In four patients with chronic external ocular infection, the staphylococci isolated from the anterior nares and conjunctiva had significant phage pattern indicating that auto-infection was playing a role.

Chromosomal transformation in corneal endothelium of rabbit in tissue culture. P. Sarker, Ph.D., P. K. Basu, M.B., and I. Miller, Departments of Ophthalmology and Botany, University of Toronto.

Corneal endothelial cells of adult albino rabbits grown in tissue culture, when checked after 10 months of explanation, showed drastic deviation from normal. The normal diploid number of chromosomes in rabbits is 44 but about 85 percent of the nuclei studied from the tissue culture showed hypertriploid numbers with a mode around 70. Apart from this change in number, these chromosomes also showed alternations in their structure.

Further studies on the autonomiclike properties of ocular extracts. Morton B. Waitzman and Ronald E. Posner, Laboratory for Research in Ophthalmology, Western Reserve University.

Previous studies in this laboratory have indicated the presence of autonomiclike substances in certain ocular extracts. A continuation of these studies indicates that dilator pupillae extracts have not only a smooth muscle-stimulating effect but also a blood pressure-lowering effect. Sphincter pupillae extracts were found to cause a rise in blood pressure and would, at very high concentrations, tend to induce rises in smooth muscle activity. Two separate autonomic-

like agents extractable from iris tissue are thus described.

The neutralization of cholinesterase inhibition by various oximes and by atropine. W. S. Hunter, M.D., and C. McCulloch, M.D., Department of Ophthalmology, University of Toronto.

The neutralizing effect of five-percent solutions of DAM, 2-oximino-3-pentanone, 3-oximine-2-pentanone and P_2S against miosis produced by DFP was studied in rabbits. P_2S solution was less effective than the others but was also less irritating. When the agents were used in 1 : 10,000 Zephiran solution P_2S showed the greatest neutralizing effect. P_2S was active against the miosis produced by phospholine iodide and demecarium bromide. Atropine produced effective dilatation after the use of DFP in the rabbit. The action of these drugs is different in different species and no conclusion can be drawn from experiments on rabbits as to the effect of the drugs on humans.

Effect of covering the eye with a contact lens upon corneal lactic acid and DPN in rabbits. N. H. Morley, Ph.D., and C. McCulloch, M.D., Department of Ophthalmology, University of Toronto.

Covering a large surface of the eye over periods up to three days was associated with marked cloudiness, increased lactic acid and decreased DPN in the corneal tissue of rabbits.

Synthesis of ATP and ADP in hog ciliary process: Acetone powder extracts. Morton B. Waitzman and Tao Huang, Laboratory of Research in Ophthalmology, Western Reserve University.

Certain enzymes fix amino groups of adenylic amidate in bacterial systems, forming thereby, amino acids (Katunuma, N., Arch. Biochem. & Biophysics, **76**:547-548, 1958). Because of the various types of adenylic acid deaminase activity found in ciliary process tissue as was reported in our laboratories (Waitzman, M. B., Am. J. Physiol., **198**:665-668, 1960), it was felt that the finding of an ammonia fixing system in ciliary process tissue could help explain some of the synthetic processes that take place at this site of aqueous humor production.

Adenylic amidate (AMP-NH_2) was incubated with various concentrations of pyrophosphate and with an acetone powder preparation of hog ciliary process tissue. It was shown that in this system a high rate of deamination and polyphosphate nucleotide synthesis took place. Myokinase-like activity was inhibited when pyrophosphate concentration in the medium approached or exceeded that of the added nucleotide and only ATP accumulated. When the pyrophosphate concentration was much less than that of the nucleotide, ADP accumulated. These experiments indicate that adenylic amidate in the presence of pyrophosphate is capable of synthesizing a high energy nucleotide system.

Nodular dystrophy of the trabecular meshwork. J. S. Speakman, M.D., Department of Ophthalmology, University of Toronto.

Recent studies of the trabecular meshwork with the electron microscope have shown an irregular distribution of collagen fibrils, possessing banding at intervals of 1000 Å. in the clear zone which surrounds the collagen core at the centre of both uveal and corneoscleral fibers. In flat-teased preparations of the uveal meshwork, with the light microscope, bundles of fibers can be identified in the clear zone. These take a spiral course around the central collagen core. An irregular pattern of fiber bundles can also be seen on the surfaces of the corneoscleral lamellae, although in a normal eye it is difficult to identify the clear zone.

In eyes removed from older individuals there may be a diffuse or local thickening of the clear zone. The spiralling fiber bundles frequently form broad hyaline bands. Localized thickening of the clear zone may produce one or more rings around the central core, or may appear as a nodular excrescence in an advanced stage of development. This excrescence closely resembles a Hassal-Henle body. These structural changes in the trabecular fiber appear to be a senile dystrophy, which begins in the innermost layers and involves the outer lamellae to a variable degree. The thickening of the clear zone and the disruption of the normal fiber bundle spirals could impede the outflow of aqueous by reducing the caliber of the drainage channels or by interfering with the physical properties of the fibers.

Luminance-duration relation in the response of the iris to photic stimulation of the retina. Mathew Alpern, Ph.D., and Donald W. McCready, Jr., University of Michigan. This study was assisted by grants from the National Council to Combat Blindness (Fight for Sight Award G216), the National Science Foundation (N.S.F.-G4420) and U.S.P.H.S. (B 1578).

The response of the iris of the left eye to a wide range of luminances (1.85 to 3.85 log trolands) and durations (4.3 to 150 msec.) of the stimulus flash seen in 13.5-degree Maxwellian view by the dark-adapted right eye was measured by infrared pupillography. Five young adult subjects were studied, of whom two were studied throughout the gamut of luminance and durations. The results were in good agreement, although individual differences could be demonstrated. A long flash of light may (under some conditions) appear dimmer than a shorter one but its ability to produce a change in area of the pupil of the contralateral eye is greater than that of shorter flashes. The kinetics of the consensual photopupil response may be described reasonably well by photochemical theory with the assump-

tions that the change in pupil area is proportional to the log of the products of the photochemical reaction.

Vergence and accommodation vs. pupil size changes associated with changes in the accommodation stimulus. Mathew Alpern, Ph.D., Gordon Mason, M.D., and Robert E. Jardinico, M.D., Department of Ophthalmology, University of Michigan. This study was assisted by U.S.P.H.S. Grant B 1578.

Pupil size changes have previously been shown to be associated with changes in the stimulus to accommodation when all other relevant variables (luminance, size, position, and so forth) remain fixed. In the present study the influence of changes in accommodation stimulus on pupil size was examined in the region where accommodation is maximum. Infrared pupillographic measurements of the pupil size were obtained simultaneously with haploscopic measurements of accommodation and accommodation vergence. The stimulus to accommodation was varied throughout the gamut of accommodation stimuli by moving a test chart along an optical bench with a Badal optometer arrangement before the right eye. Measurements on three adult male observers show a curvilinear relation between vergence and accommodation and between pupil size and accommodation. However, a linear relation was demonstrated between pupil size and accommodative vergence. If the synkinesis of these three responses is effected because change in the stimulus is associated with a single central excitation which cause a linearly related excitation of each of the three final common paths, then these results are strong evidence in support of Gullstrand's theory of presbyopia.

Preliminary studies of color mechanisms in retinal disease and trauma. O. Mortenson Blackwell, A.B., and H. Richard Blackwell, Ph.D., Institute for Research in Vision and Department of Ophthalmology, The Ohio State University.

The present studies were primarily concerned with the color mechanisms in three patients with (a) a tapizole retinopathy; (b) choroideremia; and (c) a degeneration of the internal limiting membrane of the retina. The luminosity function of wavelength, wavelength discrimination across the spectrum, and the location of neutral points in the spectrum, utilizing a spectral apparatus based upon four grating monochromators was measured. All three patients revealed the complete loss of the blue color mechanism (acquired tritanopia).

These data suggest that retinal disease and trauma always eliminate the blue cone system, often with additional differential effects upon either the red or the green cone systems.

A mechanism of light adaption. Leo E. Lipetz, Ph.D., Institute for Research in Vision, The Ohio State University.

Action potential discharges from a ganglion cell in the isolated bullfrog retina were detected in response to flashes of a 100-micron diameter light spot onto any part of its receptive field. Steady illumination with the spot onto any part of the field changed the threshold intensity of light flashes which evoked such responses, not only in the steadily illuminated portion of the field, but in the other portions as well. Scattered light was insufficient to account for this effect. Therefore, the threshold change was not dependent on the previous exposure of the receptors to light and any consequent changes in their visual pigments. These findings held for adapting light intensities from 1/10 to over a million times absolute threshold, and for resulting reductions in responsivity to light of up to 600 times. These findings indicate that the fraction of excitation reaching the ganglion cell from flash illuminated receptors anywhere in its receptive field is changed by a factor that depends, at least in great part, on the amount of activity just previously sent toward the ganglion cell from the steadily illuminated receptors; apparently the adaptation mechanism includes a change in the efficiency of excitation transmission along the neural pathways from light receptor to ganglion cell.

Some observations on fructose formation in the lens. John Kuck, Jr., Ph.D., Kresge Eye Institute, Detroit, Michigan.

The oxidation of sorbitol to fructose by a rat lens dispersion is coupled with the reduction of pyruvate occurring in glycolysis. In a medium which depresses glycolysis, the formation of fructose is also depressed but is restored by the addition of either pyruvate or DPN. Lens dispersions utilize fructose poorly. They do not appear to convert amino acids to pyruvate. Sorbitol has no effect on the glucose consumption or lactate production of lens dispersions.

SOCIETY PROCEEDINGS

EDITED BY DONALD M. LYLE, M.D.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

453rd Meeting, March 16, 1960

BRENDAN D. LEAHEY, M.D., *presiding*

OPERATIONS AT THE OUTER CANTHUS

MALCOLM W. BICK, M.D.: Two simple operative procedures at the outer canthus for the correction of senile entropion and ectropion were described in detail. The technique involves a block-wedge resection. In case of ectropion the base of the triangle is along the free lid margin. For entropion the wedge resection at the outer canthus of the lower lid is inverted, and the apex of the triangle is at the outer canthus. The area of excision is included between two crushed lines of incision created by a mosquito clamp. No conjunctival sutures are employed. The tissues are directly united. Excessive skin is excised. Dr. Bick claimed there were no recurrences and that the procedure could be employed both at the inner and the outer canthi. Notching is avoided by careful union of the marginal sutures.

PIERRE-ROBIN SYNDROME

JOSEPH DOWLING, JR., M.D., and TAYLOR SMITH, M.D.: The Pierre-Robin syndrome is characterized by the following: cleft palate, macroglossia in about 68 percent of the cases and micrognathia. There is a very high mortality rate in these patients. The tongue frequently drops back into the nasopharynx causing asphyxiation. Should the patient get through the first few months of life, the prognosis is better. The etiology is unknown. There have been associated anomalies such as facial abnormalities, congenital heart disease, and ocular abnormalities of which convergent strabismus is notable. Little attention has been paid to this syndrome in the ophthalmologic literature

The eye was reviewed in the case reported here because of a question of retinoblastoma. The pathologic findings were as follows:

The meshwork appeared to be normal, new vessels were noted on the iris and there was slight ectropion uveae. There were scattered large macrophages on the iris but they were not in large clumps. The iris appeared adherent to the lens. The vitreous was gathered forward with a completely detached retina. The pars plana was lifted off. There were large cells in the membrane which appeared to be adherent to the retinal surface. There was pigment in this membrane. The etiology of the membrane is not yet determined. The membrane varied in size and thickness. No vessel obstruction of the optic nerve could be seen in the section presented. The choroid had many plasma and polymorphonuclear cells. Again, many macrophages were noted throughout the tissue. Inflammatory cells were found about the retinal vessels.

Examination of the fundus of the opposite eye revealed that there were evidences of proliferative tissue over the retina in the periphery. It appeared to be a similar condition to that having taken place in the enucleated eye, but one that was regressing.

Discussion. DR. BICK: Is oxygen related to this condition and could it be considered an atypical form of retrolental fibroplasia?

DR. DOWLING: The child received minimal amounts of controlled oxygen. The child was full term and of normal birth weight.

SARCOIDOSIS OF THE FUNDUS

HERBERT L. GOULD, M.D. and HERBERT KAUFMAN, M.D.: A brief review of the literature and two case reports were presented. It was pointed out that sarcoidosis is a generalized systemic disease capable of involving nearly every tissue and organ of the body. Sixty-seven cases of fundal sarcoidosis were found in the literature and 41

of these appeared well reported and were analyzed. The commonly seen lesion is a retinal periphlebitis. If the chorioretinal "candle-wax spots" are found, the fundus picture is declared diagnostic. The candle-wax spots are discrete yellowish-white nodules located about the veins and appear to resemble drippings of candle-wax. Preretinal nodules may be seen in the lower posterior vitreous and seem to cast a shadow on the underlying retina. Papillitis, papilledema or optic atrophy may be found. Rarely large granulomata may be seen arising from the choroid or retina and projecting into the vitreous. Nonspecific areas of chorioretinitis also may be noted.

A high incidence of iridocyclitis was noted in the series reviewed. The cases reported demonstrated such involvement. They appeared to have a nodular, granulomatous type of iridocyclitis.

Glaucoma screening in Connecticut

Leon Kaplan, M.D., and Mrs. Grace Mills: A very comprehensive and detailed illuminating description of the program for glaucoma screening in Connecticut was presented. Dr. Kaplan and Mrs. Mills hold executive positions in the Connecticut Chapter of the National Society for Prevention of Blindness. It was pointed out that no detail must be left unchecked to enable a smoothly functioning screening program. For the public protection, ophthalmologists must offer direction and guidance. The program must be considered an educational one. It was felt that it would be almost impossible to screen adequately all individuals over the age of 40 years in the Connecticut population. The public must be informed of the need for periodic eye examinations to detect glaucoma and check the ravages of the disease. Dr. Kaplan felt that the public health department should assume some responsibility in this type of program. Where ophthalmologists are involved, the public should know that the professional medical organization is supporting and participating in the program. Proper recognition of the support and assistance of other lay organizations can also be included in the circulars. The efforts of this group were to be commended highly.

Variations in corneal thickness

David Donaldson, M.D.: A binocular attachment for the slitlamp to enable accurate and effective studies on the normal and pathologic corneal thickness was described. Dr. Donaldson employed the Haag-Streit slitlamp and used a specially designed ocular containing a splitfield lens. By means of a micrometer screw attached to the ocular, accurate measurements could be made. Magnification of ×40 was employed.

On the corneas studied five readings were taken in each instance and these were averaged. Dr. Donaldson claimed that the average cornea has a 0.537 mm. thickness but that the normal range of thickness is between 0.44 and 0.69 mm. In postoperative cataract patients studied, the cornea was found to increase in thickness by 75 percent or more on the first postoperative day. A gradual reduction in thickness took place thereafter. The amount of striate keratopathy observed did not necessarily parallel changes of increase in corneal thickness. All measurements were taken centrally in the cornea. The accuracy of measurements becomes less as one approaches the periphery of the cornea. The central 15 degrees is fairly even in thickness. Dr. Donaldson indicated that his test was performed using a monocular device.

Evaluation of photocoagulation

Graham Clark, M.D.: Dr. Clark prefaced his discussion by stating he would limit his remarks to his own observations. The instrument now being used is called the light coagulator or the photocoagulator. He felt that the instrument was here to stay and he has employed it during the past two years. Initially rabbits were used, but recent observations have been on man. The instrument is operated manually under direct vis-

ual control. Two explosions were experienced and were quite disconcerting. A mechanical cause was found. It was due to reflection of heat and subsequently remedied.

The photocoagulator is not a definitive instrument although it has passed through the research phase. At the present time it is being employed mainly in clinical research. Because it has only been in operation about five years, therapeutic use and effectiveness must be carefully evaluated.

Dr. Clark cautioned the generalized use of this instrument. He felt that the success of the instrument and its assessment varied with European and American authors.

Dr. Clark stressed that the photocoagulator could be used to prevent retinal detachment, but was not the instrument to treat retinal detachments. If a suspicious retinal area is noted in a detachment, it can be walled off. It can be used to seal off a leak in what is otherwise an apparently successful retinal detachment operation. He feels it is an instrument to supplement retinal detachment surgery.

Contrary to previous thinking, there is an effect on the vitreous by this instrument. The change occurs chiefly where there is formed vitreous, and of course this is in the younger age group.

The diabetic individual must not be treated with this instrument. The blood vessels react poorly to this light beam.

Dr. Clark uses the instrument in the presence of macular holes. He feels that there is always another area to be found in the retina. One spot of light for approximately one-half second may cure the patient, when the defect is found. The photocoagulator does not replace the surgery, but supplements it. It enables increasing the security in retinal detachment surgery and can be used prophylactically.

As a diagnostic instrument, its value is found in proliferative vascular disease. In cases of Eales' disease, which is now being broken down into several classifications, the photocoagulator can be effective in arresting the disease. Further follow-up is necessary, however. Hemangiomas of the choroid are treated quite successfully. This, however, is still based on a short follow-up period. One must treat lightly at first and gradually increase the therapy. The mode of action is believed to be direct mechanical obliteration of the vessels by scar tissue.

The photocoagulator is not, in and of itself, a method of treatment for tumors such as retinoblastoma. Chemical radiation and other forms of therapy should be used also. The instrument is of value in treating recurrences in the scar in retinoblastoma.

In treatment of the anterior segment, it is possible to form a new pupil in the iris wherever desired, where the iris is updrawn. Surface lesions are removed best by excision, because the biopsy is always available.

The periphery of the eye is extremely difficult to treat. The light breaks up and an accurate direct focus is not always possible. Scleral depression aids in viewing and treating such areas. The presence of a small pupil creates further difficulty. Dr. Clark noted that when the light beam struck the pupillary margin, the sphincter went into prolonged and acute miosis.

Dr. Clark prefers to treat patients under sedation whenever possible. The retrobulbar anesthesia may create more discomfort and less co-operation. By sedation, such as with Thorazine or Demerol, satisfactory results have been obtained. He cautioned against the publicity the instrument was receiving now. He hoped that the reports would be filtered carefully.

Discussion. Dr. Schepens cautioned strongly against the prophylactic use of this instrument in treating retinal detachments. Small breaks in the retina have been observed in a number of patients who have no detachment. These should not be treated prophylactically with the photocoagulator. It is unnecessary to get marked reactions in the retina and choroid. Pigmentation has appeared in the retina when it was known that no reaction was visible in the tissues by di-

rect observation at the operating table. Those who use the coagulator look for a white mark in the retina. Dr. Schepens feels that too much has been done already. Use of this instrument by people who are not informed adequately can produce more damage to the retina, choroidal hemorrhages from large vessels, etc. He urges a more cautious use of this instrument, and one which is much less vigorous. He feels that one should be pessimistic about the treatment of tumors with the photocoagulator. The heat from the beam is dispersed immediately when the light strikes the surface of the tumor and therefore it does not penetrate to the center.

Dr. Clark agreed entirely with the comments of Dr. Schepens. He agreed that it was necessary to cut down on the amount of reaction. He affirms that the presence of a reaction indicates that you have destroyed tissue. The original amount of dosage has been found to be excessive. He agreed that in treating tumors there was a weakness in that the light did not penetrate deeply.

Dr. Dunphy: Have any iridectomies been attempted when the lens is in place?

Dr. Clark: I cannot conceive of performing peripheral iridectomies in the presence of an intact lens. I feel that a change would take place in the capsule and a cataract would form.

Dr. Leahey: Can you go through a dense pupillary membrane thus creating a discission?

Dr. Clark: A pupillary membrane does not interrupt the beam sufficiently to produce an effective opening.

Dr. Stone: Can corneal vascularization be treated with this instrument?

Dr. Clark: The photocoagulator has had little success in treating blood vessels in the cornea.

Dr. Dias: What is the energy level with this instrument?

Dr. Clark: The energy level can not be measured successfully. The heat obtained does not depend on the point of focus, but on the point of interruption of the beam, and therefore in reply to the question as to whether there was "a boiling in the vitreous" with the beam, Dr. Clark felt that there is none. The heat occurs when the pigment layer interrupts the beam.

Dr. Brockhurst: A mercury vapor type of lamp is used in experimenting with rabbit eyes in seeking to develop an indirect ophthalmoscopic attachment for the instrument so that we may better visualize the periphery and immobolize some of the lesions. However, the lamp is not a strong enough source of light for use with the human eye. Would indirect ophthalmoscopy be useful?

Dr. Clark: Regarding Dr. Brockhurst's question, an indirect ophthalmoscopic attachment would be a tremendous asset.

D. Robert Alpert,
Recorder.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

November 2, 1959

Dr. Joseph Laval, *presiding*

Tubular fields due to glaucoma

Dr. Joseph Laval in his presidential address reported on various types of glaucoma operations performed on patients with very restricted fields. In contrast to the prevailing view that operation in such cases causes loss of the remaining field, these patients did well. Dr. Laval feels that the tubular field is not a contraindication to glaucoma surgery.

Extraocular paresis due to cerebral aneurysms

Dr. Bernard Kronenberg said that many patients with a paretic muscle have an aneurysm of the carotid system. The danger to life which this presents makes a proper diagnosis mandatory, and justifies cerebral angiography in many cases in spite of the dangers of this procedure.

Differential diagnosis includes trauma, diabetes, multiple sclerosis, cerebrovascular accidents, and brain tumors. Patients with aneurysm may or may not show, in addition to the paretic muscle, field changes, exophthalmos, visual loss and pain.

Visualization by arteriography leads to treatment by ligation of the involved vessel, with retention of life and, in some cases, restoration of function. Four cases were reported.

Glaucoma operation using a Gelfilm seton

Dr. Jules M. Yasuna described a new filtering operation for glaucoma in which an incision is made into the angle and a strip of Gelfilm is imbedded in the incision to keep it open for a number of months. The technique is (1) miotics pre- and postoperative; (2) large limbal-based flap; (3) a 6-0 corneal silk traction suture is placed at the 12-o'clock position; (4) an ab externo incision is made into the angle parallel to the face of the iris; (5) if the iris prolapses, the prolapse is excised, otherwise no iridectomy; (6) a T-shaped piece of Gelfilm is used; the vertical arm is place in the incision which is held open by the suture and a cyclodialysis spatula. The horizontal arm of the T prevents the Gelfilm from going in too far.

Results in 50 operations performed for various types of glaucoma were reported. In some, massage was temporarily necessary but in all the tension was controlled during the follow-up period, which is one year, the longest, to three months, the shortest. The operation is simple, safe and effective. There is little likelihood of cataract formation or other complications.

Effect of alpha chymotrypsin on zonule of Zinn

Dr. Harvey Thorpe reviewed the anatomy of the lens attachments, emphasizing Hanover's canal, Petit's space and the hyalocapsular ligament. This area can often be seen with a gonioprism. The technique of operation is: (1) scleral incision with preplaced sutures; (2) evacuate aqueous and put in air bubble; (3) inject 0.25 cc. of the enzyme; (4) after two or three minutes irigate the enzyme out; (5) remove lens, using pressure alone or capsule forceps (erisophake causes more striate keratitis).

Apparently alpha chymotrypsin first separates the attachment of the zonule from the lens, then weakens the zonuiar fibers themselves and then, in some cases, digests the fiber completely.

Alan H. Barnert,
Corresponding Secretary.

Ophthalmic Miniature

It should be realized that a pair of spectacles is just as much an optical instrument as a telescope or a microscope and should be looked on in this way, and not, as many do, as a peg on which to hang all one's discontent and lack of confidence.

Ida Mann and Antoinette Pirie,
The Science of Seeing, 1946.

AMERICAN JOURNAL OF OPHTHALMOLOGY

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WHAT IS THE ISSUE?

It is 100 years since Donders published his essay on "Ametropia and its results." In general, prior to the work of this Dutch physician and ophthalmologist, spectacles were selected by the wearer and purchased from the optician. Eye glasses were ready-made appliances. Young (physician) had discovered astigmatism of the eye in 1793, Ware (physician) had investigated hypermetropia clinically in 1813, Airy (astronomer) had developed the cylindrical lens (1827), and texts on diseases of the eye had included errors of refraction (Lawrence, 1833; Hays, 1854). A few ophthalmologists were pioneering in the prescribing of spectacles but, in general, patients found to need glasses were advised to "try a series of them

at the optician's shop." Others went to the optician on their own initiative.

Helmholtz's "Treatise on physiological optics," 1856, was followed in 1858 by Donders' paper on the use and selection of spectacles; in 1860 by "Ametropia and its results," and in 1862 by his "Accommodation and refraction of the eye." This provided the scientific basis for the evaluation of the refraction of the eye and the prescribing of spectacles. *All* clinical practice in refraction has been based on his work. We speak of "scientific breakthroughs" in medicine. Donders' classic revolutionized ophthalmology.

Some physicians were to argue that spectacles were "the province of the optician," that the "fitting" (actually prescribing) of spectacles was beneath the dignity of the physician but the outcome was inevitable: refraction did become an integral part of ophthalmologic examination, and entered into differential diagnosis. Spectacles ceased to be the "province of the optician" when they ceased to be over-the-counter merchandise and became a therapeutic agent. The prescribing of spectacles by the physician was incorporated into private practice and into the services of the charity clinics in the United States.

And the opticians? During the last half of the 19th century, while the practice of refraction was spreading among ophthalmologists, opticians, depending on their interest, education, and initiative, assumed an increasingly active role in the process of spectacle selection. While physicians were prescribing spectacles, and opticians were supplying glasses on these prescriptions, opticians were also "fitting" spectacles. Nevertheless most of the glasses sold in the United States as late as 1872 were ready-made spectacles.

By the end of the 19th century opticians had begun to undergo division into those who chose to limit their activities to providing glasses in accordance with the prescription of the physician, and those who chose not to so limit themselves, and to designate themselves "refracting opticians." Many opticians already had trial cases which were used in dispensing. Snellen's optotypes were available to anyone who wished to buy them.

It was acknowledged by the optician that the *eye* is the province of the physician, but arguing that "a lens treats light, not the eye," refracting opticians sought and obtained licensure as *optometrists* in every state by 1924. One of their leaders had proposed that opticians be licensed to prescribe glasses as a temporary measure, anticipating that all refraction would presently be done by physicians in the course of medical care.

Optometrists gained legal recognition, preserving to them the right to supply glasses on their own authority. Fifty years ago 80 percent of eye glasses were procured without examination and diagnosis by a physician.

Optometrists have remarked the lack of increase in their numbers, in the face of a tremendous growth in population. The medical profession has grown steadily in number of physicians qualified in and practicing ophthalmology. Despite legal recognition of the optometrist, the public trend toward obtaining medical examination and prescription of glasses by a physician has been—not reversed but accelerated. Today half of the glasses distributed in the United States are prescribed by physicians. It may be presumed that this trend will continue.

The medical profession does not endorse self-diagnosis. It can not do other than advise diagnosis by the physician before the procurement of glasses. While spectacles do not injure the eye, their availability may defer examination by the physician and so delay the diagnosis of blinding disease.

Certainly the training to be required of one who would hold himself out to the public as competent to give a qualified opinion about the eye and the visual system, to determine the *need* for medical care or the *absence of any need*, can not be *less* than that required to qualify to enter upon the practice of medicine. The training of the special-

ist must begin with a general medical training.

Will any man suggest that for the eye, and the second to seventh cranial nerves, and their associated pathways of the brain, there should be an exception?

Shall the patient with *ocular* complaints be singled out for management by one with less than the physician's training?

The examination of the patient and the diagnosis of the absence of disease, or of deviations from the normal (disease) is the essence of the practice of medicine. With reference to the eye—the visual system—it is the practice of ophthalmology. This is true whether or not surgery is performed. Neither medicine nor any of its branches may be defined in terms of method or means of treatment. Ophthalmology is not merely the practice of ophthalmic surgery; and the exclusion of surgery, or of surgery and the use of drugs, does not make it something other than medical practice. We believe that the majority of optometrists recognize this.

Medicine shares with optometry that portion of the field of medicine which deals with refraction without the use of drugs. Optometry is not a medical service. The optometrist does not participate in the medical care of patients. Although he is not qualified to decide that a physician's services are *not* required, he may sometimes realize that the person who comes to him for refraction needs services only a physician can give. We believe most optometrists adhere to the concept that their function is refraction and the correction of refractive errors by glasses—a concept which is in agreement with the expressed views of the medical profession.* Optometrists have earned a measure of respect from ophthalmologists in refraction.

In noncycloplegic refraction optometry has adopted a part of medicine's refractive procedures. Nevertheless, the medical profession has declared voluntary professional association with the optometrist unethical, that is, contrary to the interest of the patient. Why?

What *is* the issue between medicine and optometry?

The medical profession has an obligation to clarify this matter in the public mind. The opinion of the medical profession will be the more respected if it is supported with a frank authoritative statement of the issue.

For some years optometry has sponsored legislation and court actions which have brought it into conflict with medicine. Legislative extension of optometry to make it, in effect, ophthalmology-without-surgery-and-drugs (or in some instances, ophthalmology-without-surgery) represents an evasion of the medical practice act which threatens the public interest. By law, optometry now exercises jurisdiction over one ancillary medical worker, the optician, in several states. Legislation has been proposed repeatedly that would threaten the ancillary worker in the physician's office by the device of defining optometry in terms that could be used to accuse supporting medical personnel of "practicing optometry."

Those who are charged with responding to these situations at the state level deserve and require full information of the experience of other states and of the implications of what confronts them.

It is important that all recognize that, although ophthalmologists in the care of their patients are most often confronted with the problem of optometry, the conflict is with *medicine*. It is medicine that must meet the issue. Those physicians engaged in ophthalmology have a duty to make available to the profession as a whole their knowledge borne of experience. It is their privilege and duty to communicate facts to the state society and American Medical Association delegates and to utilize proper forms so that a broadly based expression may be available for the guidance of medicine's official bodies which determine policy and official position. In the American Medical Association the forum is the Section on Ophthalmology; the policy-

* J.A.M.A., volume 159, p. 927.

making body is the House of Delegates.

Those whose official duty it is to inquire into these matters should make known their findings. If there is to be resolution of the apparently divergent views, it must be frankly acknowledged that disagreement exists, and its nature must be clearly and dispassionately defined. Medicine owes this to itself, to optometry, to the people. Clarification is absolutely essential.

Derrick Vail.

THE RETINA IN SEVERE HEMORRHAGE*

The flood of medical discovery rises so quickly that it is not surprising that many old but important facts become submerged. The effects of severe hemorrhage on vision provide a case in point; and Pears and Pickering have done a useful service in reporting instances of two kinds of visual change which were well known 50 years ago but have since been largely forgotten.

The first consists in sudden loss of vision, usually after a large hemorrhage. Pears and Pickering observed the retina in one such case from the onset of the blindness, which was unilateral. The earliest change was enlargement of the retinal veins on the second day, followed later by swelling of the disc and eventually by optic atrophy. This is a rare condition and is usually preceded or accompanied by loss of consciousness and convulsions—that is, by symptoms of cerebral anoxia. Death of the ganglion cells may of course be a direct result of anoxia; but the delayed onset of blindness, in some cases, and the papilledema suggest that the major lesion may be in the optic nerve itself, in which histologic abnormalities have in fact been described. Although lack of red corpuscles may play some part in causing these changes, the sudden fall of blood-pressure seems likely to be more important. Unilateral blindness has been observed to follow the administration of hypotensive agents in anesthesia. Goldsmith and Hewer suspected occlusion of the central retinal artery by spasm, while Gillam suggested that external pressure on the eyeball may be a factor.

The second and commoner complication of hemorrhage is a form of neuroretinopathy which closely resembles that found in malignant hypertension. Pears and Pickering describe several such cases. In this condition there is little visual disturbance apart from occasional blurring of vision, but papilledema is common and focal hemorrhages and exudates are present. These usually resolve eventually without leaving any obvious abnormality. It is therefore unlikely that any permanent damage is caused, and the changes seem to be due to escape of blood from abnormally permeable vessel walls. Although this could conceivably be a result of anemia, which is known to cause similar changes, the lesions seem to be more closely related to sudden falls in blood-pressure. The resemblance to the retinopathy of malignant hypertension is of particular interest. In both conditions, especially the latter, there is evidence of raised intracranial pressure. Clinical observations throw little or no light on the cause of this raised pressure. In experimental malignant hypertension, gross or even fatal cerebral edema is regularly present, and it is possible but not proven that a similar cerebral edema may account for the swelling of the nervehead. The retinal hemorrhage and exudates cannot in either case be attributed to papilledema; and the presence of essentially similar lesions in two unrelated diseases suggests that some common factor—probably focal ischemic anoxia—is concerned. In experimental malignant hypertension, Byrom has demonstrated focal exudates and hemorrhage in both the brain and the retina, and has shown that these are related to reversible constriction of small arteries. If the focal retinal lesions in cases of hemorrhage are also anoxic in origin, the simplest explanation is that when the arterial system is suddenly depleted of blood the

* Reprinted from *The Lancet*, October 22, 1960, p. 916.

critical closing pressure is reached and isolated segments of small arteries are temporarily closed. There is no direct clinical evidence to support this explanation, which does not readily account for the appearance of lesions, in some cases, some days after the hemorrhage has apparently been corrected. But, as Pears and Pickering point out, this may simply mean that retinal damage of this kind does not always become immediately visible.

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OBITUARY

CARROLL R. MULLEN
(1900-1961)

Dr. Carroll R. Mullen, professor of ophthalmology and head of the Department of Ophthalmology at Jefferson Medical College and executive and attending surgeon at Wills Eye Hospital, Philadelphia, died on February 1, 1961, of acute leukemia in Jefferson Hospital.

He was born in Bloomington, Illinois, November 9, 1900, the eldest son of a physician, took his premedical degree at Creighton University, Omaha, Nebraska, and was graduated from Jefferson Medical College in 1926. He was an intern and resident at the Philadelphia General Hospital.

A charter staff member of the Fitzgerald-Mercy Hospital, he was also attending ophthalmologist-in-chief at Jefferson Hospital and a consultant at Philadelphia General, the Veterans Hospital, Philadelphia, and J. Lewis Crozier Hospital, Chester.

He was a fellow of the American College of Surgeons, the American Academy of Ophthalmology and Otolaryngology, the Pan-American Association of Ophthalmology, and the Philadelphia College of Physicians; a diplomate of the American Board of Ophthalmology, and a member of the Association for Research in Ophthalmology, the Pennsylvania Academy of Ophthalmology, the American Medical Association, the Philadelphia County Medical Society, and the Pennsylvania Medical Society.

He was elected chairman of the Section of Ophthalmology of the College of Physicans of Philadelphia in 1959 and re-elected in 1960. He was chairman of the first Wills Eye Hospital conference and chairman of the conference scheduled for this month.

He was a life trustee and a director of the Free Library of Philadelphia, succeeding the late Dr. A. S. W. Rosenbach as chairman of the committee on exhibits; a member of the Board of City Trusts, and a lay trustee of Villanova University.

CORRESPONDENCE

Aid to Cuban Ophthalmologists

Editor,
American Journal of Ophthalmology:

The newspapers have informed the American public of the large number of Cuban refugees who have escaped the tyranny of the Castro regime in their homeland. It did not seem to be a matter that concerned us individually until it came to our attention that 10 of these were ophthalmologists who had been forced to leave their practices more or less precipitately in the past several months. They were unable to bring anything out with them and for the most part are without resources.

The University of Miami School of Medicine has set up a postgraduate course to train and certify these men in order that they may qualify for work in the United States. The university, however, has no funds for the day-to-day living of these un-

fortunate colleagues of ours. Their need is urgent.

To meet the immediate need the Pan-American Association of Ophthalmology has sent $3,000.00 from its treasury to the University of Miami School of Medicine who will administer all funds for the exiles. Much more is needed to help these, our colleagues, in distress. It is for this reason that an urgent request for contributions is addressed to all American ophthalmologists.

Checks should be made payable to the Pan-American Association of Ophthalmology, 921 Exchange Building, Memphis 3, Tennessee.

(Signed) J. Wesley McKinney, M.D.,
Sec.-Treas. North of Panama.

Correction

Editor,
American Journal of Ophthalmology:

I would greatly appreciate having a correction printed in The American Journal of Ophthalmology. The error has occurred in the omission of the name of Dr. Frank P. Furgiuele in the letter entitled, "Treatment of herpetic keratitis by cauterization with silver nitrate," published in the January, 1961, issue of The Journal on pages 182-183. I intended that both our names would appear under the title as in the original paper. I did not expect that only the signature would be included otherwise I would have signed it with Dr. Furgiuele's before my own.

(Signed) Theodore W. Sery, Ph.D.,
Philadelphia, Pennsylvania.

Negative preoperative culture and postoperative infection of the eye

Editor,
American Journal of Ophthalmology:

The value of preoperative cultures of the bacterial conjunctival flora has been doubted. Operative interventions in negative cases have ended in disastrous infection of the eye while infected conjunctivas did not prevent an uneventful healing of the corneoscleral incision. It can be presumed that the latter event is due to the preoperative rinsing of the conjunctical sac, the resistance of the tissues and to the good luck of the patient and the surgeon. The question arises how an infection can occur in a clean case. It may come from the operator, from the instruments and from the air in the theatre. A more likely source of infection is the nose of the patient. It has been recognized during the last years that the nose is in many cases a reservoir of pathogenic cocci. In my small practice I have received several reports from the laboratory stating that the conjunctiva was sterile and the nose infected. Now, the postoperative bandaging of the eye nearly abolishes the tear secretion and the downward current in the nasolacrimal canal. Thus, the nasal cocci can easily ascend into the conjunctival sac and find a suitable pabulum. Sometimes the conjunctiva of the bandaged nonoperated eye becomes infected while the operated eye, which has been rinsed before the operation and is cleaned daily, escapes infection. It is advisable not to be satisfied with a negative conjunctival culture unless the nasal culture is also negative.

(Signed) H. Lytton,
London, England.

Stippling of the cornea following use of collyrium eyewash

Editor,
American Journal of Ophthalmology:

In the past year I have collected 11 cases of stippling of the cornea which I believe to be due to the use of a collyrium eyewash (Wyeth Laboratories).

The collyrium was used for different reasons. Two patients had chalazia. Two patients complained of tired eyes and therefore used the wash. Three had a foreign body sensation prior to the use of the collyrium. The others had slight pain or redness.

Following the use of the collyrium the complaints were uniform. There was some

burning each time immediately after instillation. Within 24 hours there was tearing, light sensitivity and blurring of vision.

Examination with the slitlamp showed fine stippling of the surface of the cornea. There was no staining with fluorescein.

Hydrocortone or Neodecadron eyedrops were used in nine cases. No treatment was used in the last two cases. All cleared within 72 hours.

One patient had used the collyrium in September, 1959, and I had noted stippling but at the time did not realize the cause. In June, 1960, he again returned with stippling of the cornea and gave a history of having used the same bottle of collyrium.

Collyrium is used very extensively and I have collected only 11 cases in one year. It is possible something happens to the preparation when it is kept too long on the druggist's shelf. Perhaps the concentration of preservative becomes affected on standing. Another possibility is that these individuals are sensitive to some constituent which does not affect the majority of individuals who use the preparation.

(Signed) Jesse J. Michaelson
165 North Village Avenue,
Rockville Centre, New York.

MODIFIED IRIDENCLEISES

Editor,
American Journal of Ophthalmology:

In the article by Gyula Lugossy "Modified iridencleises" in the June, 1960, issue of THE JOURNAL, he describes his technique as "incarceration of the pigmented epithelial coat facing the bulbar conjunctiva" (p. 1377). He mentions this several times. Yet in the summary (p. 1379) he describes the "pigment epithelial surface facing the sclera." Is the last statement an error? The success of the surgery depends on the position of the pigment layer.

(Signed) M. M. Kulvin,
Miami, Florida.

DR. LUGOSSY'S REPLY

Editor,
American Journal of Ophthalmology:

I am certainly most grateful to Dr. M. M. Kulvin for having called my attention to the error in the summary of my paper "Modified iridencleisis." It is misleading indeed to read " . . . pigment epithelial surface facing the sclera," instead of " . . . facing the conjunctiva," which is the correct version. I shall make the required correction in the reprints.

(Signed) Gyula Lugossy,
Budapest, Hungary.

BOOK REVIEWS

LICHTKOAGULATION. By Gerd Meyer-Schwickerath. Stuttgart, West Germany, F. Enke, 1959. 94 pages, 55 illustrations, seven in color. References. Price: DM 15.60.

LIGHT COAGULATION. By Gerd Meyer-Schwickerath. (Translated by S. M. Drance.) Saint Louis, Missouri, C. V. Mosby Company, 1960. 111 pages, 55 illustrations, seven in color, references. Price: $9.50.

By this time the entire ophthalmologic world is familiar with Meyer-Schwickerath (hereafter known as M-S), his light coagulator and the excellent results in a variety of ocular diseases that he has obtained by its use. The apparatus is now to be found almost in every part of the world and the literature about its use and results is becoming somewhat redundant. It is timely, therefore, that his own book on the subject appears. It is particularly helpful to English readers that the excellent and accurate translation by Stephan M. Drance, M.B., F.R.C.S., associate professor of ophthalmology, University of Saskatchewan, Canada, should appear so soon after M-S's German work.

M-S began his work in 1946 after pondering over the long-known effect produced by

solar burns of the retina and brilliantly conceived the idea of an instrument that would deliver a burning beam of light directly to a retinal target in disease of this tissue. It took him "four years of work to translate this idea into the first clinically usuable instrument." Improvement of the design and widening of indication for its use rapidly followed.

It is difficult to understand why M-S, in his discussion of the historical background of the subject, should overlook the classical and pioneering studies of Frederick H. Verhoeff and Louis Bell. Their paper, "The pathologic effects of radiant energy on the eye," together with a systematic review of the literature by Clifford B. Walker appeared in the *Proceedings* of the American Academy of Arts and Sciences (**51**: [No. 13] 630 [July] 1916). This work is referred to by Duke-Elder (*Textbook*, volume 6, 1954, p. 6492).

One of the interesting and pertinent remarks made by Verhoeff and Bell that is particularly apt here is "The character of the histological changes clearly indicates that the heat conversion took place chiefly in the pigment epithelium and inner layers of the choroid, and that the outer layers of the retina proper were affected by the heat conducted therefore." (Pages 698-699.)

I am certain that had M-S been aware of these studies by Verhoeff and Bell, it would have saved him a lot of trouble and probably would have speeded up the development of his excellent and most valuable contribution to ophthalmology.

M-S, now chief of the City Eye Clinic of Essen, West Germany, has divided his short book into four chapters. The first regards the "Historical and experimental background of radiation damage to the retina." Chapter two consists of a general introduction to light coagulation, with a complete description and method of using the Zeiss light coagulator, examination and care of the patient; limitations, contraindications and complications of light coagulation—one might say the meat of the subject. Chapter three deals with the present indications for light coagulation. This is a most excellent detailed description of the author's experience in a very large number of cases and will repay most careful study.

The final chapter consists of a description of and instructions for the use of the iris coagulator, in fashioning a new pupil, coagulation of iris tumors and tumors on the surface of the eyeball.

The enthusiastic stampede to own and use the light coagulator has not been too good a thing. M-S is the first to point out the limitations and even hazards in its use by the inexperienced. He endured permanent damage to one of his own eyes as the result of his early work.

It is quite necessary, therefore, that anyone who contemplates using the coagulator should know exactly what he is doing at all times. The book, lucidly translated by Drance, is therefore of great value and interest to all ophthalmologists. All honor to M-S.

Derrick Vail.

THE CHOICE OF A MEDICAL CAREER. Essays on the Fields of Medicine. Edited by Joseph Garland, M.D., and Joseph Stokes, III. Philadelphia, J. B. Lippincott, 1961. 231 pages. Price: $5.00.

Under the present situation in residency training the young physician must often make his decision as to the branch of medicine in which he desires special graduate training before he is truly qualified to do so. Residency appointments in some institutions are made two or three years in advance while the student is a senior or even junior medical student, and before real contact and understanding of a specialty afford a rational basis for its selection. This volume, which presents an essay on each of 19 medical specialties, offers an appraisal which should be studied with interest and profit by the student when contemplating his future career.

Each specialty is described in some detail

by an eminent authority in the field, with descriptions of required training, Board demands, and the nature, possibilities, and limitations of each field. While each author is naturally prejudiced no attempt is made to oversell or overstate the case. Dr. Francis H. Adler presents the story for ophthalmology in his usual lucid and forthright style. The 10 pages devoted to our specialty offers an excellent summation of what many of us regard as the "queen of the specialties."

The first and last chapters of this book, dealing with "The art and the science" and "Caritas medici" offer the neophyte in medicine much excellent philosophy and advice. While the student may not be able to make a final choice of a career on the basis of these essays, there is no doubt that he will be aided in making his final selection and will be less likely to make his choice on the basis of a momentary whim or erroneous notion.

William A. Mann.

DOCUMENTA OPHTHALMOLOGICA. (Advances in Ophthalmology.) Edited by G. von Bahr, G. B. Bietti, J. ten Doesschate, H. Fischer-von Bünau, J. François, H. Goldmann, H. K. Müller, J. Nordmann, A. J. Schaeffer and A. Sorsby. 'S-Gravenhage, W. Junk, 1960. Volume XIV, dedicated to Prof. M. Amsler, Zurich. 413 pages. Price: 72 Dutch guilders.

For three days in September, 1959, a symposium on "Uveitis" was held in Munich, Prof. Amsler in the chair. Forty ophthalmologists from Germany, Switzerland, Belgium, Hungary, India, France, Italy, Turkey, Greece, Great Britain, Finland and the United States (five) were present either in person or as joint authors of the papers that were presented.

Volume XIV of the influential and important *Documenta Ophthalmologica* is entirely devoted to the contributions of this symposium. The papers are in German, French and English, with summaries in the official languages.

Although, unfortunately, the information set forth by the essayists has not put us much further along the road to complete understanding of this difficult symptom of a "sick eye in a sick body," there has been some clarification pointing to the way ahead, and some boulders that were obstructing our path have been removed.

The authorities, made up of research workers and clinicians, discussed many phases of the problem, including serology, diagosis, antibodies, allergy, viruses (especially Behçet's disease), tuberculosis, toxoplasmosis, focal infections, streptococcal uveitis (negative report) leptospirosis, brucellosis and even a small bit of uveitis geographica.

The papers will repay a careful study and this volume deserves a special spotlight in our growing library on uveitis.

Derrick Vail.

SOCIAL RESEARCH AND BLINDNESS. By Milton D. Graham, Ph.D. New York, American Foundation for the Blind, 1960. Paperbound, 177 pages, bibliography, index. Price: $2.50.

A remarkable amount of social research on blindness has accumulated in the past five years. This compilation covers 959 items, of which 60 percent deal directly on the aspects of blindness and 40 percent represent research and monographs pertinent to this field. One half of these recent articles are concerned with the young blind. More data and statistics are needed on the social characteristics of the blind in the United States; on the standards and practices of organizations serving the blind; on the implications of blindness in the social settings of home, school and employment; and on means of increasing the mobility of the blind. Further research is required, especially for the adult blind, on vocational training, vocational opportunities, personal adjustment and optical aids.

James E. Lebensohn.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Kobayashi, M. and Sato, S. **Electron microscopy of the corneal epithelial cells.** Acta. Soc. Ophth. Japan **64**:1286-1293, July, 1960.

This is a comparison of normal and regenerated corneal epithelium in rabbits by electron-microscopy in section. In regenerated epithelium the intercellular space is great, the intercellular bridges are absent, the mitochondria are small, and cristate mitochondrialis and limiting membrane are not obvious, most endoplasmic reticulum is vesicular, and the Golgi apparatus is pronounced. (8 figures, 12 references) Yukihiko Mitsui.

Menna, F. **The structure of arteries and veins as they anastomose between the uvea and the sclera in human and in guinea pig eyes.** Arch. di ottal. **64**:141-153, May-June, 1960.

Human eyes were enucleated post mortem, fixed, and stained in three ways. The arteries and veins of the iris and uvea were compared to those of the sclera in the human, the guinea pig, and in the rabbit eye. The scleral arteries were larger and had thicker endothelium than the uveal arteries. The muscle layers were thicker and normal in content of fibrous tissue and elastic tissue, compared to uveal arteries in which fibrous tissue and elastic tissue were scant.

Scleral arteries communicated with uveal arteries, but also by direct anastomosis with uveal venous spaces. This was considered to be a barrier mechanism to counteract excessive intraocular pressure, and to neutralize size shape changes during pupil size changes in the iris. (14 photomicrographs, 21 references)

Paul W. Miles.

Ono, H. **Electron microscopic studies of ciliary epithelium in rabbits.** Acta Soc. Ophth. Japan **63**:2614-2630, July, 1959.

Ono reports this study of ciliary epithelium in thin sections by electron microscopy. In 18 electron micrographs the author found that the ciliary epithelium consisted of internal limiting membrane, nonpigmented epithelium, pigmented epithelium and basement membrane. The fine structure of each layer is then described. Finally he discusses the "large granules" which are seen in the cytoplasm of nonpigmented epithelium. He

considers the large granules and pigment granules to be equivalent to each other. (18 figures, 36 references)

Yukihiko Mitsui.

Taniguchi, Y. **Electron microscopy of pigment granules of retinal epithelium.** Acta Soc. Ophth. Japan **63**:2515-2524, July, 1959.

In this study of tissues from various experimental animals, the pigment granules of the retina are usually cigar-shaped. Occasionally they are egg-shaped, spherical or irregular. The granules are composed of numerous microgranules. The microgranules have a similar shape to the respective mother granule. The cigar-shaped granules have filaments at both extremities and the filaments are four to five times longer than the granules. Taniguchi considers that the filaments may have a role in the migration of the pigment granules. (24 figures, 3 tables, 7 references) Yukihiko Mitsui.

Tomita, I. **Electron microscopic studies on the fine structure of blood vessels in the human iris.** Acta Soc. Ophth. Japan **64**:1447-1459, July, 1960.

The blood vessel of the human iris consists of one layer of endothelial cells, a basement membrane, and a thick adventitia. The connection of endothelial cell is firm and there is no discontinuity or pore. The basement membrane adheres tightly to the outside of the endothelium and is fenestrated. Through the whole of the basement membrane the endothelial cells are in contact with pericytes. The adventitia consists of collagen fibrils and is dense at the ouside of the vessel. On the inner side of the vessel the adventitia is not pronounced and can even be absent. In the adventitia chromatophores can occasionally be seen. An elastic membrane can not be seen in an iris artery. (14 figures, 22 references)

Yukihiko Mitsui.

2

GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Mulgaria, A. and Scardoni, C. **Experimental contribution to the study of the parallergic phenomenon in ophthalmology.** Rassegna ital. d'ottal. **29**, March-April, 1960.

The present number of the Rassegna presents a continuation of the aricle with the same title as that in the issue for October-November, 1959. In the present article the local stimulation was activated by the introduction of bacterial lysates and tuberculin. This favored a rise of specific granulomatous changes. The authors believe that the presence of circulating germs in the tissues, put there either by anterior chamber injection or endogenous injection, are of great value. The results of autopsies and histologic studies of the eye add to the value of these difficult ophthalmologic problems. (2 photographs) E. M. Blake.

Okamoto, I. **Adenovirus isolation from conjunctival scraping.** Acta Soc. Ophth. Japan **63**:3653-3662, Oct., 1959.

The author attempts to isolate adenovirus by means of tissue culture of human amnion cells. Epidemic keratoconjunctivitis, pharyngoconjunctival fever, acute follicular conjunctivitis and catarrhal conjunctivitis with preauricular adenopathy are the source of the material. After 246 attempts, 67 strains of adenovirus were isolated; 63 of the 67 strains were type 8. Others were type 3 (two strains), type 2 (one strain) and tvpe 11 (one strain). (1 figure, 1 table, 37 references) Yukihiko Mitsui.

Tanaka, C., Araki, K. and Wataya, T. **Precipitin reaction in agar for studies of epidemic keratoconjunctivitis.** Acta Soc. Ophth. Japan **63**:3207-3211, Aug., 1959.

Paired sera from 35 patients who had a

clinical diagnosis of epidemic keratoconjunctivitis were tested for precipitating antibody response to adenovirus type 8. Twenty-five of them (71.4 per cent) showed a fourfold or greater rise in precipitating antibody titer during the illness. Four cases showed no precipitating antibody response. In the majority of cases the precipitating antibody titer began to increase two weeks after the onset of disease. The peak titer, 1:32 on the average, was reached in four to six weeks. The highest titer was 1:128.

Seven cases of verified type 8 infection showed a considerable rise in precipitating antibody titer against type 8 virus during the illness without exception. Six of them, however, did not show any rise in precipitating antibody titer to type 3 virus. The authors consider that the precipitin reaction has a relative type of specificity. (3 figures, 4 tables, 7 references) Yukihiko Mitsui.

Yoneyama, K. **Measurement of the caliber of the retinal blood vessel and the retinal blood pressure in patients with nephrosis and nephritis.** Acta Soc. Ophth. Japan **64**:323-351, Feb., 1960.

In 19 patients with nephrosis the retinal blood pressure and vessel caliber were normal. In none of 31 cases of acute nephritis was a retinal change found. However, the retinal blood pressure was apt to be high even if the systemic blood pressure remained normal. In such cases, however, the vessel caliber was normal. In patients with systemic high pressure, a narrowing of retinal blood vessels was obvious. Retinopathy was found in 10 of 108 cases of chronic nephritis. The retinal blood pressure and vessels showed the same tendency as in acute cases. (14 figures, 63 tables, 39 references) Yukihiko Mitsui.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Caffi, Maria. **The lipids of the normal human cornea.** Rassegna ital. d'ottal. **29**:114, March-April, 1960.

Microscopic studies have shown that the pigment granules revealed by the use of Sudan nero B. are principally triglycerides, phospho-lipids and cholesterol. These substances occur principally in the endothelium and the stroma. It is to be noted that Bowman's membrane is free of stain. (3 figures) E. M. Blake.

Endo, A. **Migration of iodine into ocular tissues.** Acta Soc. Ophth. Japan **64**:665-674, 743-752, 973-977, April, May, June, 1960.

The sodium iodide given intravenously into rabbits penetrates most easily into the sclera. However, radioactive NaI^{131} penetrates most easily into the cornea and not into the sclera. The penetration of the iodine into the vitreous is extremely poor but once it penetrates it does not disappear for a long time. When the eye is exposed to infra-red rays for 20 minutes prior to the injection of iodine, the penetration of the agent into ocular tissue is considerably accelerated. (15 figures, 8 tables) Yukihiko Mitsui.

Fukami, I., Sugimoto, K., Matsumura, T., Oguri, F. and Morioka, M. **A study of cattle lens protein.** Acta Soc. Ophth. Japan **64**:1623-1629, July, 1960.

Alpha and β-crystalline from the lens of cattle were tested for infrared absorption. Both fractions showed a similar absorption in the range of 3500-750 cm^{-1} of the wave length and may have a similarity in the molecular structure. The absorption by these lens fractions is much more complicated than that by albumin and globulin. Both fractions of the lens did not show any definite difference in

the absorption of ultra-violet rays. However, after lyophilization α- and β-crystalline showed entirely different physical properties. (10 figures, 14 references)

Yukihiko Mitsui.

Gonzalez Costea, J. A. **Electrophoretic study of the corneal proteins.** Arch. Soc. oftal. hispano-am. **20**:478-483, June, 1960.

The technique used in this investigation is described and the electrophoretic patterns are illustrated. With the technique used it is possible to demonstrate six hydrosoluble protein fractions in the rabbit cornea, two of which contain the largest amount of protein and are most resistent to decomposition in a humid atmosphere in the icebox. The progressive disintegration of the proteins thus preserved is demonstrated. Without discussing the importance of protein conservation in the graft in keratoplasty, it is pointed out that the sooner the graft is used the less its proteins are altered. (7 figures)

Ray K. Daily.

Hernandez-Benito, E. and Gil del Rio, E. **The combination of prednisone and butazolidin in ophthalmology.** Arch. Soc. oftal. hispano-am. **20**:512-518, June, 1960.

After the report on the synergistic action of the combination of butazolidin and prednisone in general medicine, the authors investigated its possibilities in ocular diseases, when used locally and internally. It was administered internally in a variety of ocular diseases. The dose used in these cases was 200 mg. of butazolidin and 75 mg. prednisone for three days, then 200 mg. of butazolidin and 50 mg. of prednisone for the next three days followed by 100 mg. of butazolidine and 25 mg. of prednisone for as long as two or three months. It was effective to a degree in herpetic keratitis, intolerance to contact lenses, chronic conjunctivitis, episcleritis, rheumatic iridocyclitis, postoperative irritation, and phlyctenular conjunctivitis. There was no effect in choroiditis and glaucoma. The authors injected deltabutazolidin intramuscularly and could not demonstrate the drugs in the anterior chamber unless the iris was irritated previously. This seems to indicate that the inflammatory ocular process diminishes the barrier to drug penetration into the eyeball. Butazolidin alone and in combination with prednisone was also used locally. A one-percent ointment was found to be well tolerated by the eye and was effective in spring catarrh and phlyctenular conjunctivitis.

Ray K. Daily.

Hirota, K. **Effect of various noxious agents on the action potential of the optic nerve.** Acta Soc. Ophth. Japan **64**:1342-1370, July, 1960.

The effect of various agents on the action potential of the optic nerve was studied in vitro. The agents were cocain, chlorpromazine, sublimat, ethanol, methanol, formaline, formic acid, atropine, eserine, acetylcholine and epinephrine. The effect of the agents generally appears first on the slow potential and then on the spikes. The recovery occurs first in the spikes and then in the slow potential. When sublimat, formic acid and formaline were used the recovery of the action potential did not occur or only slightly. The minimum effective concentration is described for each agent. (44 figures, 2 tables, 51 references)

Yukihiko Mitsui.

Itoi, M. **Corneal collagen.** Acta Soc. Ophth. Japan **64**:898-903, 1105-1109, May, June, 1960.

Itoi reports an attempt to reconstitute collagens in test tubes. Animal corneas were extracted with acid at a low temperature and citric buffer was added to the extract. The precipitants thus obtained were examined by electron microscopy and typical collagen fibrils were demonstrated. Then Itoi treated animal

cornea and sclera with pepsin and acetic acid at 25°C. By this means he was able to extract acid-insoluble collagen. The fibrils were reconstituted from the solution by the addition of salt and adjustment of the pH. The reconstituted fibrils were demonstrated by electron microscopy. He believes that he has extracted acid-soluble and insoluble collagen and reconstituted the fibrils in vitro. (9 figures, 1 table, 33 references)

Yukihiko Mitsui.

Iwasaki, K. **The effects of adrenocortical hormone and ACTH on mitotic activity of the corneal epithelium.** Acta Soc. Ophth. Japan **64**:553-576, March, 1960.

A topical or systemic administration of cortisone causes a reduction in mitosis count of corneal epithelium. The mitosis-impeding action of colchicine was definitely accelerated by an addition of cortisone and, therefore, Iwasaki believes that cortisone interferes with mitosis in its initial phase. The systemic administration of ACTH has a similar effect on the mitosis of corneal epithelium. (11 figures, 17 tables, 30 references)

Yukihiko Mitsui.

Kogure, F. **Enzymochemical studies on the transplantation of corneal heterograft.** Acta Soc. Ophth. Japan **64**:1391-1400, July, 1960.

Kogure noted the changes in the antitrypsin content of rabbit's serum after keratoplasty. After an auto-keratoplasty no increase in antitrypsin occurred in the animals. The graft remained transparent in three of the eight eyes. After a homo-keratoplasty the antitrypsin began to increase four days after surgery. The maximum value was reached in one week and the normal value was regained in three to four weeks. The surgery was successful in two of the four eyes. After a hetero-keratoplasty (chicken as the donors) the antitrypsin showed a similar change as in case of homo-keratoplasty but the surgery was not successful in any of the 16 eyes. (5 figures, 5 tables, 89 references)

Yukihiko Mitsui.

Konta, S. **Experimental studies on ocular manifestation of choline deficiency.** Acta Soc. Ophth. Japan **64**:1118-1132, June, 1960.

Young rats were fed with food which was deficient in choline. Systemically degeneration of kidney, fatty liver and atherosclerosis resulted. In the eye an intraocular hemorrhage was observed in seven of 108 animals. The hemorrhage took place from the ciliary body and spread into the vitreous through the posterior chamber. A hemorrhage from a retinal vein also occurred. Mucoid degeneration and thickening and proliferation of endothelial cells were obvious in all of the ocular blood vessels. (24 figures, 1 table, 54 references)

Yukihiko Mitsui.

Marconcini, E. **A new local anesthetic in ophthalmology, balcaina.** Arch. di ottal. **64**:165-169, May-June, 1960.

A one-percent solution of alpha-diethylamino-2,6 dimethyl acetanilide given by injection compared favorably to novocaine in eight cases. Paul W. Miles.

Mimura, Y., Yoshida, R., Uyama, T., Shiozaki, Y. and Ichihashi, K. **Allergic reactions due to lens substances.** Acta Soc. Ophth. Japan **64**:1578-1583, July, 1960.

The bovine lens did not change its antigenicity when the SH-group of the lens substance was blocked by para-chloromercurybenzoate. When the lens substance was heated to 100°C for one hour or its carboxyl groups were methylated it lost its antigenicity entirely. The effect of acetylation, denaturation by guanidine, and enzymatic cleavage on its antigenicity was variable. The antigenicity of α-crystalline was resistant against denaturations and trypsin digestion. The β-

fraction of bovine lens had three kinds of antigens; one was characteristic for bovine lens and was destroyed by denaturation, another showed a cross reaction with human lens and the last showed a cross reaction with rabbit and horse lens. (2 figures, 1 table, 10 references)

Yukihiko Mitsui.

Mukai, A. **A study of optic nerve metabolism.** Acta Soc. Ophth. Japan **64**: 1041-1045, 1087-1104, June, 1960.

In the first part of this project the migration of P^{32} into the visual pathway was studied in rabbits. Three groups of rabbits were used: 1. rabbits with talcum arachnoiditis, 2. those injected with paraffin into the cerebral ventricles and 3. normal controls. The talcum arachnoiditis slightly accelerated the migration of P^{32} into the visual pathway while paraffin injection considerably suppressed it. In the second part change in the optic nerve metabolism after removal of the eyeball was studied in dogs. In the optic nerve the oxygen uptake increased after surgery for 50 days whereas in the chiasm and corpus geniculatum it decreased after surgery up to 30 days. The carbohydrate uptake decreased in all parts of the pathway after surgery. Changes in anaerobic metabolism are also discussed in detail. (29 tables, 70 references)

Yukihiko Mitsui.

Muto, R. **Transaminase in ocular tissues.** Acta Soc. Ophth. Japan **64**:42-68, Jan., 1960.

The content of glutamic oxalacetic and glutamic pyruvic transaminase in ocular tissues was studied. In the first part of this report the distribution of these enzymes in rabbit eyes are described. The activity of these enzymes is high in the retina and uvea and is very low in the cornea, lens and aqueous. In the second part a measurement in the chick embryo is described. The activity of the enzymes in the eye reaches the peak on the fifteenth day of incubation. The relation of the enzyme activity to the adaptation is discussed in the third part. By light adaptation the activity of the enzymes increases in the frog retina. In the final part the influence of pentrating injury of the eye is described. It causes a decrease of the enzyme activity in the rabbit retina. (3 figures, 35 tables, 116 references)

Yukihiko Mitsui.

Ochi, M., Takeuchi, M. and Koyama, T. **Viability of rabbit cornea stored at low temperature.** Acta Soc. Ophth. Japan **64**:1401-1410, July, 1960.

The measurement of oxygen uptake of rabbit cornea stored at low temperatures by means of an oxygraph is described. From the standpoint of oxygen uptake, 20-percent glycerin-Ringer solution is a good preservation medium. Among low temperatures $-79°C$ is best to preserve the vitality. The cornea must be frozen slowly. After one month's storage at $-79°C$, the QO_2 of the cornea is 0.359. (7 figures, 5 tables, 49 references)

Yukihiko Mitsui.

Ohashi, K. **Histochemical studies on phosphorylase in the ocular tissue.** Acta Soc. Ophth. Japan **64**:290-298, 435-441, 605-611, Feb., March, April, 1960.

In the first part of this project the change in the retinal phosphorylase after subconjunctival injection of cortisone in rabbits was studied. After cortisone administration the enzyme in the retina becomes reduced for the first three hours. Then it begins to increase to reach the maximum after 24 hours. In the cornea the phosphorylase does not show a definite change by cortisone but the PAS-reaction is definitely reduced one hour after cortisone administration. Then it begins to increase and reaches the maximum in 24 hours. In the last part the change in the retinal phosphorylase after iron penetration into the eye is described.

The enzyme in the retina decreases rapidly in the course of 24 hours after insertion of an iron needle into the vitreous. (32 figures, 56 references)

Yukihiko Mitsui.

Oishi, M. **Ophthalmic use of kanamycin.** Acta Soc. Ophth. Japan **64**:753-756, 998-1008, May, June, 1960.

Kanamycin is co-operative with penicillin, streptomycin, neomycin and tetracycline, but is antagonistic to chloramphenicol and indifferent to erythromycin. Tested with staphylococcus strains isolated from ocular lesions, eight percent of the strains were resistant to kanamycin, while 11 percent of the strains were resistant to neomycin and 71 percent to streptomycin. In vitro the development of resistance to kanamycin is slow and after 20 transfers the minimum inhibitory concentration rose 50-fold. A cross-resistance was recognized between kanamycin and neomycin but not between the former and streptomycin. (9 figures, 11 tables, 48 references)

Yukihiko Mitsui.

Sanchez-Salorio, Manuel. **Cycloplegia and mydriasis with "Mydriatic-Roche."** Arch. Soc. oftal. hispano-am. **20**:1072-1092, Oct., 1960.

This is the report of a comprehensive investigation of a new cycloplegic, not yet on the market, Ro-1-7683-17 (2) which is a parasimpaticolytic of Syntropan. It is used in a one-half percent solution, two drops instilled one minute apart. The authors investigated its cycloplegic and mydriatic properties, using as criteria paralysis of accommodation and the size of the pupil. The charted and tabulated data show that paralysis of accommodation sets in rapidly, 80 percent of the amplitude being lost in five minutes. In ten minutes the loss reaches 90 to 95 percent, the residual accommodation being less than one diopter. Recovery begins in 40 minutes. In one hour the recovery of accommodation exceeds 1.4 diopters and is less than two. In one and one-half hours the accommodation has returned to three diopters, which permits reading, and after two hours the amplitude is between four and six diopters. After three hours 80 to 90 percent of the amplitude of accommodation has recovered, and the remainder recovers slowly within the next three hours. Mydriasis begins within three minutes, reaches maximum in 15 minutes, and stays there for two hours; recovery begins after three hours and is complete in six hours. The author concludes that this drug is a more rapid cycloplegic with a shorter duration than any other drug. The degree of cycloplegia is equal to that of one-percent homatropine. As a mydriatic it is more rapid and more certain than ten-percent phenylephrine but the degree of mydriasis is somewhat inferior to that of phenylephrine. It is particularly useful for refraction. The cycloplegia makes it less suitable than phenylephrine for fundoscopy alone. (7 figures.)

Ray K. Daily.

Sugita, Y., Yodokawa, M. and Tanabe, T. **Electroretinographic studies in experimental siderosis.** Acta Soc. Ophth. Japan **64**:1427-1437, July, 1960.

An iron needle was introduced into the rabbit vitreous. The change in the ERG was followed for one month. The amplitude of the b-wave showed a gradual decrease in some cases, no change in some others, and a gradual increase in the rest of the cases. The a-wave showed changes similar to those of the b-wave. The latent time of the b-wave was apt to be prolonged in most cases. Histochemical changes of the retina are also discussed. The decrease and increase of the b-wave amplitude are parallel with the activity of the alkaline phosphatase in the retina. (7 figures, 33 references)

Yukihiko Mitsui.

Takaku, I., Nakamura, S., Niizuma, Y., and Endo, A. **Swelling of rabbit cornea by intracorneal injection of ethylendiamine tetra-acetate (EDTA).** Acta Soc. Ophth. Japan **64**:265-271, Feb., 1960.

An isotonic solution of sodium-EDTA causes a remarkable swelling of the rabbit cornea when injected into the corneal stroma. The change is a localized edematous swelling of the cornea, appears in two hours after the injection, reaches the climax in six hours, and disappears in 24 hours. A solution of Ca-EDTA-and saline solution does not show such an effect. A solution of sucrose showed a slight but similar effect as sodium-EDTA. By chemical analysis a hydration of the cornea by sodium-EDTA is obvious. (5 tables, 18 references)

Yukihiko Mitsui.

Tokunaga, F. **Influence of cortisone on retrobulbar tissue of the mice.** Acta Soc. Ophth. Japan **63**:1963-1996, July, 1959.

Young Wistar mice were used as experimental animals. Two milligrams of cortisone or hydrocortisone were given to the animals intraperitoneally every day for four weeks. During the period of from seven to fourteen days after beginning cortisone administration, an exophthalmos developed in some of the animals. By biopsy it was shown that there was a definite edema in the retrobulbar tissue during the first two weeks which was followed by a hyperplasia of adipose tissue.

Blood plasma was taken from the mice after cortisone administration. The plasma was injected into new-born chicks with radioactive P^{32}. The plasma accelerated the fixation of the tracer into the thyroid gland. The author therefore considers that the way of cortisone in causing exophthalmos is through the thyroid gland. (10 figures, 24 tables, 166 references) Yukihiko Mitsui.

Tomizawa, A. **Ocular manifestation of deficiency in pantothenic Acid.** Acta Soc. Ophth. Japan **63**:3314-3339, Aug., 1959.

This is a study of pantothenic acid deficiency in rats. Ocular effects are evident in three weeks and the symptoms are blepharo-conjunctivitis, pannus formation, and opacity and ulceration of the cornea. Histologic retinal and choroidal changes are definite and they are: reduction in the cells of the visual cell layer and outer nuclear layer and depigmentation of the choroid. The systemic changes are also described. (38 figures, 3 tables, 93 references) Yukihiko Mitsui.

Usui, I. **Studies on the chemical components of sclera and cornea by high potential paper electrophoresis.** Acta Soc. Ophth. Japan **64**:923-958, May, 1960.

The sclera of animals was extracted with methanol and the extract was analyzed by means of a horizontal type of high-potential paper electrophoresis. Seventeen fractions which were stained by ninhydrin were demonstrated and 11 of them were identified as amino-acids. The fraction 7 which was identified as serine, aspartic acid and hydroxy-proline, was found in the greatest amount. The cornea had the same electrophoretic fractions as the sclera. In the cornea, however, the fractions 5 and 6 which were identified as glutamic acid, valine, leucine and isoleucine, were found in the greatest amount. (15 figures, 11 tables, 34 references) Yukihiko Mitsui.

Verdaguer, J. and DeCamino, T. **New inhibitors of carbonic anhydrase.** Arch. chilenos oftal. **17**:17-26, Jan.-June, 1960.

The authors studied the effects of the newer products Daranide and Neptazane on normal and glaucomatous eyes. The effect of an isolated dose and the effect of doses over a longer period of time are recorded as well as the effect these drugs

have on the blood chemistry. (6 tables, 22 references) Walter Mayer.

Wada, M. **An experimental siderosis of the eye.** Acta Soc. Ophth. Japan **64**:1267-1285, July, 1960.

A piece of iron was introduced into the vitreous of a rabbit's eye. The iron-ion increased definitely in the vitreous in the course of a few weeks. The iron-ion can appear in the aqueous but the amount is very small. When cyclodiathermy was done before the insertion of the iron, the increase of the iron-ion in the vitreous was considerably accelerated. At the same time, the iron-ion penetrated into the inner layers of the retina, and severe retinal damage was brought about. (27 figures, 9 tables, 53 references)

Yukihiko Mitsui.

Yoshida, B. **Electron microscope studies of the pigment epithelium.** Acta Soc. Ophth. Japan **64**:1658-1681, July, 1960.

Sodium iodate was given to rabbits and changes in the pigment epithelium of the retina were followed by electron microscopy. Changes in the electroretinogram (ERG) were also studied for comparison. The earliest change in ERG was a decrease of c-wave. At this time an enlargement of the endoplasmic reticulum was obvious by electron microscopy. Thirty minutes after the administration of the agent, the c-wave disappeared. At this time the following changes were obvious by electron microscopy: vacuole formation, an appearance of dense matrix in the basal part of the cells, and partial destruction of the elastic membrane. (28 figures, 3 tables, 45 references)

Yukihiko Mitsui.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Aznarez Garcia, J., Herrero Zapatero V. A. and Aznarez de Herrero M. P. **The preblem of a false macula.** Arch. Soc. oftal. hispano-am. **20**:431-437, June, 1960.

The problem of eccentric fixation is briefly discussed and two cases are reported. One patient, 10 years of age, was treated successfully and the other, 16 years old, is still under treatment which promises a successful outcome. The pattern of therapy, following that of Cüppers, consisted of extinguishing the eccentric fixation area, re-educating the true macula, pleoptics for recovery of normal vision, orthoptics until normal sensory relationships are established, and surgery when indicated. The authors found a flash superior to the ordinary euthyscope and they conclude that, contrary to the general opinion, treatment can be effective in older children, at least until the age of 10 years.

Ray K. Daily.

D'Esposito, M. and D'Agostino, A. **A method to predict results of treatment in amblyopia.** Arch. di ottal. **64**:183-190, May-June, 1960.

It is well known that some cases of amblyopia ex anopsia are not likely to respond to treatment. In addition to the usual criteria such as the patient's age and the presence of central fixation, tests of visual acuity with and without a telescopic lens may prove useful. Study of a series of 20 cases suggests that if a 1.8× telescopic lens does not improve the acuity of an amblyopic eye, pleoptic treatment will not either. (1 table, 27 references) Paul W. Miles.

Duch Bordas, Francisco. **Examination of the light sense by Comberg's methods.** Arch. Soc. oftal. hispano-am. **20**:901-970, Sept., 1960.

Comberg's comparative and threshold methods are described, and the advantages of this examination illustrated by the reports of six cases. The exploration

of the light sense by these methods is particularly useful in patients with markedly reduced visual acuity and in patients in whom the use of large adaptometers is not feasible. In patients who are immobilized after surgery for retinal detachment this examination affords prognostic information. In perforating injuries, and in eyes with old traumatic cataracts in which the fundus is inaccessible to examination, the response to the light sense test reveals the functional state of the retina. In complicated cataracts and in old retinal detachments the examination enables one to predict the results of surgical intervention (3 references)

Ray K. Daily.

Jordano Barea, Diego. **Biomathematical topology and theories of vision.** Arch. Soc. oftal. hispano-am. **20**:1093-1111, Oct., 1960.

This is a mathematical exposition of processes of visual perception, a detailed analysis of Land's theory of vision, and a discussion of the relationship between the mathematical and physiological processes involved in vision and orientation. (18 references) Ray K. Daily.

Kido, R. **Dynamics of accommodation.** Acta Soc. Ophth. Japan **63**:2037-2056, July, 1959.

The author introduces a new conception in the field of accommodation. It has been believed that the amplitude of accommodation is constant in a person. He can see a subject at any distance when it is in the region of accommodation. He can also see a subject at a certain distance by any degree of accommodation provided that the degree is in the range of accommodation and that the excess or deficiency of the accommodation is corrected by proper glasses.

The study by the present author demonstrated that the latter is not the case. Many persons can not see a subject at a far distance under a strong accommodation, even if the degree of accommodation is in the amplitude of accommodation of the respective person and the excess of the accommodation is neutralized by a proper concave lens. The amplitude of accommodation which can be used for distant vision is often less than one third of the total power of accommodation. Likewise, many persons can not suspend the accommodation completely when they see a near object, even if the deficiency of accommodation is supplied by a proper convex lens. (50 figures, 10 tables, 31 references) Yukihiko Mitsui.

Konishi, K. **Dynamics of accommodation.** Acta Soc. Ophth. Japan **64**:1046-1065, June, 1960.

The amplitude of accommodation is not constant in an individual. It varies greatly according to the eye-object distance. A person who has, for example, 8 diopters of accommodative amplitude calculated from far point and near point, can not see the far point in general when a concave lens of 8 diopters is applied. Sometimes, even a concave lens of 2 diopters can not be compensated by accommodation. This phenomenon is due to the impression of eye-object distance. (12 figures, 38 tables, 20 references)

Yukihiko Mitsui.

Lijo Pavia, J. and Marcone, G. **Human macula.** Rev. oto-neuro-oftal. Sudam. **35**: 81-88, Oct.-Dec., 1960.

This article deals with the functions of the macular area and in particular with the foveal region. The authors summarize the theories advanced to explain the physiology of vision. The physiologic optics of vision as well as the theory behind the establishment of the Snellen charts is discussed. (3 figures)

Walter Mayer.

Losada, Jesus. **The physiopathology of**

color perception. Arch. Soc. oftal. hispano-am. **20**:549-811, July, 1960.

This monograph with an extensive bibliography was the chief presentation of the 53rd Congress of the Hispano-American Ophthalmological Association. The volume is divided into five chapters, which summarize our present knowledge of the anatomy of the retina, the physiology of color vision, the congenital dyschromatopsias, the theories of chromatic vision, the methods of investigation, and the acquired disturbances of color perception. The author concludes that color perception and its anomalies still present a fertile field for research and that this comprehensive review of the literature should serve as a starting point for further investigations to clarify the still inadequately understood phenomena of color perception and its disturbances. (99 figures, 666 references)

Ray K. Daily.

Pasmanik, G. and Kleiner, E. **Normal retinal adaptometry.** Arch. chilenos oftal. **17**:35-43, Jan.-June, 1960.

The authors have undertaken a study of dark adaptation using the Goldman-Weekers adaptometer. The patients in their study were submitted to tests in perception, differential sensitivity and visual acuity in darkness as well as in illumination. It is felt that the use of this instrument is very helpful in obtaining theoretical and practical knowledge of dark adaptation and that this knowledge is very important in matters dealing with traffic regulations. (6 tables, 22 references)

Walter Mayer.

Weiland, G. **Light spectacle glass "ORMA 1000" made of hard plastics.** Klin. Monatsbl. f. Augenh. **137**:496-499, 1960.

A new type of glass has been developed which combines the advantages of crown glass and plexiglass without having any of their disadvantages. Some of the special features of this product are: light weight, almost unbreakable, hardness of surface, perfect optical qualities. The tolerance of optical precision is ±0.01D for neutral and ±0.03D for spherical lenses. The process of production is described. The lenses are manufactured by Emil Busch, GmbH, Optische Industrie, Göttingen, West-Germany.

Gunter K. von Noorden.

5

DIAGNOSIS AND THERAPY

Baurmann, H. **The phenomenon of the entoptically visible flow of blood. Part I.** Klin. Monatsbl. f. Augenh. **137**:621-629, 1960.

Leucocytes migrating through the retinal capillaries can be visualized entoptically by viewing a blue light. A mercury vapor lamp with a blue filter (350-450 m) was employed to produce the entoptic phenomenon; 165 subjects with normal and abnormal leucocyte counts in the peripheral blood were examined with an arrangement permitting subjective estimates of the number of corpuscles seen within a certain area of blue light, which could be altered by means of an iris diaphragm. The results thus obtained corresponded strikingly with those from peripheral blood counts. (1 figure, 2 tables, 31 references)

Gunter K. von Noorden.

Baurmann, H. **The phenomenon of the entoptically visible flow of blood. Part II.** Klin. Monatsbl. f. Augenh. **137**:630-633, 1960.

In his first communication the author pointed out that the phenomenon is due to leucocytes moving through the capillaries of inner retinal layers. The blood corpuscles are not visualized, however, in the center of the entoptically visible fundus. This corresponds to the avascularity of the macula. By means of an iris

diaphragm the amount of blue light entering the eye, necessary to visualize the first blood corpuscle, was determined. These experiments yield interesting data regarding the density of capillarization of paramacular tissue. (2 figures, 10 references) Gunter K. von Noorden.

van Beuningen, E. G. A. **A pulse-synchronous automatic electro-ophthalmodynamometer.** Klin. Monastbl. f. Augenh. 137:410-418, 1960.

This is the description of an electronic method to measure retinal artery pressure as well as to estimate the ocular arterial output per minute. Technical data and description of the equipment are given in detail. (8 figures, 14 references) Gunter K. von Noorden.

Carbonell Cadenas de Llano and Bartolozzi Sanchez, R. **Electronystagmography.** Arch. Soc. oftal. hispano-am. **20**:458-466, June, 1960.

The authors' technique for electronystagmography is described in detail and the tracings of two patients with congenital nystagmus are analyzed. In institutions where cooperation between the ophthalmologist and the electroencephalographic service is available this form of exploration is valuable because of the objectivity and precision of the findings. The method affords an analysis of the quick and slow phases of nystagmus, a determination of the frequency, the amplitude and angular deviations of the movements, and a facile recognition of pendular nystagmus which otherwise is sometimes difficult. (8 illustrations, 13 references) Ray K. Daily.

Jordano Barea, Jose. **A schema for the colirium test of Coppez in the diognosis of anisocorias.** Arch. Soc. oftal. hispano-Am. **20**:972-973, Sept., 1960.

The author describes a circular schema with four concentric circles for the etiologic diagnosis of anisocoria. In the central circle are the three drugs used in the test, namely, cocaine, atropine and eserine. The second and third circles illustrate graphically the effect of the drugs on the two eyes. The fourth circle contains the diagnosis. Ray K. Daily.

Keller, B. **Experiences with Tosmilen eye drops.** Klin. Monatsbl. f. Augenh. 137:471-482, 1960.

Tosmilen is a cholinesterase inhibitor and consists chemically of two molecules of neostigmin connected by a polymethylen chain. The therapeutic efficacy of this drug as to its miotic and antiglaucomatous effect was subjected to a clinical trial. Considerable side effects observed do not justify therapeutic indication of this new preparation. (4 figures, 3 tables, 12 references) Gunter K. von Noorden.

Radnot, M. and Gall, J. **Our experience with Uveline.** Klin. Monatsbl. f. Augenh. 137:634-636, 1960.

Uveline is an orthoxy-chinoline derivative. It was topically used in 32 patients with photoelectric conjunctivitis and keratoconjunctivitis. Subjective symptoms improved remarkably. Uveline drops were also used to facilitate ophthalmoscopy and gonioscopy in patients with glaucoma associated with corneal opacities. Gunter K. von Noorden.

Suda, K. and Furushima, M. **A convex plunger of the tonometer.** Acta Soc. Ophth. Japan **63**:2445-2451, July, 1959.

The authors report their trial of a tonometer which has a convex plunger. The radius of curvature of the convex end of the plunger is 1.5 mm. It was possible to measure a considerably greater range of the ocular pressure without changing the load. The authors consider that the convex plunger is considerably superior to Schiøtz concave plunger or to the McLean plane plunger. (4 figures, 11 references) Yukihiko Mitsui.

Tsunematsu, M. **A clinical measurement of ocular vessel caliber.** Acta Soc. Ophth. Japan **64**:173-184, Jan., 1960.

The author measured the caliber of ocular vessels in various conditions. He had 47 hypertensive patients, 20 with glaucoma, 10 with chronic retrobulbar optic neuritis, 10 with optic nerve atrophy and 10 with central retinitis. In hypertensive cases there is a definite narrowing of the retinal and anterior ciliary arteries. In glaucoma there is a considerable dilatation of the anterior ciliary artery and vein but little change in retinal vessel caliber. In retrobulbar neuritis and central retinitis there is a narrowing of the retinal artery. In optic nerve atrophy there is a contraction of most of the ocular vessels. (2 figures, 15 tables, 27 references)

Yukihiko Mitsui.

von Wolffersdorf, H. **Clinical experiences with guaiacol-glycerin-ether as muscle relaxant in 1,575 ophthalmic operations.** Klin. Monatsbl. f. Augenh. **137**: 450-469, 1960.

This combination has been employed successfully and represents a relatively harmless and nontoxic muscle relaxing drug. Its pharmacological action is, in contrast to curare and its derivatives, effective in the midbrain and the intermediate neurons of the spinal cord. Cataract, glaucoma, and detachment surgery as well as keratoplasties can be performed safely without akinesia or retrobulbar injection when this drug is used. The ocular muscles are relaxed and the globe is hypotonic. Circulation and respiration are not influenced, intubation is not necessary. Nystagmus disappears under the influence of this drug. Its disadvantages are an injection time of 6 to 24 minutes (varying with the size of patient) and hypotony of the globe which is undesirable to many surgeons. The drug is available as M Y 301 "forte" (Fa. Dr. Brunnengräber, Lübeck, West-Germany) and G G G "forte" (Chemische Fabrik VEB, Berlin-Grünau). (6 figures, 5 tables, 86 references)

Gunter K. von Noorden.

Zamorani, G. **Early results of the use of Lanthosal.** Rassegna ital. d'ottal. **29**: 103, March-April, 1960.

The author reports his use of therapeutic doses of Lanthosal and potential oxygen. The medication is supposed to overcome vascular spasm. The amount of oxygen introduced into the tissues appears to aid recovery. The author reports 65 cases treated with Lanthosal, including subatrophic neuritis, 13 cases of chronic glaucoma with tension reduced, five cases of myopic chorio-retinitis and 31 cases of retinitis pigmentosa.

E. M. Blake.

6

OCULAR MOTILITY

Barraquer y Cerero, Tomas D. **Voluntary nystagmus.** Arch. Soc. oftal. hispano-am. **20**:467-469, June, 1960.

The literature on voluntary nystagmus is briefly reviewed and a rare case reported. The daughter of Doctor Ochoa, a distinguished gynecologist of Madrid, acquired voluntarily through exercise rapid lateral movements of the eyeballs, which simulated a congenital nystagmus. The oscillations which she could produce were of medium frequency, horizontal and pendular, and were associated with slight clonic contractions of the upper lid. The ocular functions, muscular coordination and visual acuity were normal.

Ray K. Daily.

Beiras, A. **Photographic recording of deviations in strabismus.** Arch. Soc. oftal. hispano-am. **20**:1122-1128, Oct., 1960.

To provide accuracy and a standard procedure for photographic recording the author advocates that the reflexes of a light focused on the cornea should be

used as photographic indicators of the position of the visual axis. For still greater accuracy the distance of the reflex from each limbus can be measured. He describes the technique of this procedure in detail, and suggests means to avoid interference by reflexes from glasses, extraneous lights or the electronic flash. (figures) Ray K. Daily.

Bosso, Giancarlo. **The behavior of retinal correspondence after intervention for control of heterophoria.** Rassegna ital. d'ottal. **29**:134, March-April, 1960.

Continuous study of retinal correspondence in the field of strabismus yields little encouragement. After surgical intervention with or without orthoptic measures only eight percent of the author's cases were normal. Orthoptic measures are indicated, before or afterwards. (1 figure) E. M. Blake.

Dosi, F. **The use of eserine in the diagnosis and treatment of concommitant convergent strabismus.** Rassegna ital. d'ottal. **29**:122, March-April, 1960.

The treatment of the neuromuscular defects of the eyes by the use of eserine has been reported by the present writer and others. The consensus is that the miotic is of value through changing the angle of deviation. It is also of value in hyperopia and in the correction of the spherical component by convex lenses, since the correction of this element is of first importance. The author presents a careful analysis of 65 cases.

E. M. Blake.

Frandsen, A. D. **Occurrence of squint. A clinical-statistical study on the prevalence of squint and associated signs in different groups and ages of the Danish population.** Acta ophth. Suppl. 62, 1960. 158 pages.

The material for this study consisted of healthy children, young adults and adults over 30 years of age, mentally retarded and feeble-minded children, and finally a series of squinters between six months and 15 years of age. The prevalence of squint rises from one to seven percent at the age of six to seven years; this is followed by a gradual fall to 0.8 percent amongst young adults. Convergent squint is prevalent in infancy and decreases statistically from the age of seven years and divergent squint increases in frequency. No sex variation was found. The corresponding curve for mentally disturbed children runs equal courses but the averages are considerably higher. While the average in normal children was 4.5 percent, it was 10 percent for mentally retarded, 12 to 25 percent for feeble-minded subjects and 30 percent for the mentally defective. There was a relationship in the normal material between occurrence of squint, intelligence and social level. Fifteen percent of all squints was congenital, 25 percent appeared between two and three years of age, 25 percent between three and four, 12 percent between four and five, 12 percent between five and six, and 12 percent between six and seven. Strabismic amblyopia occurred in 3.1 percent of normal and 6 percent of retarded children. In both groups the level of grave amblyopia was relatively constant, whereas mild amblyopia depended on the course of the frequency curve for squint. Strabismic amblyopia was seen in 1 percent of young adults. Grave amblyopia was seen very often among mentally defective children. Convergent squint increased among the normal subjects from infancy up to the age of seven years, remained constant between seven and 16 years and improved suddenly after this age. At the same time the frequency of convergent squint approached that of divergent squint. The squint angle in the abnormal material was more frequently wider. The degree of squint affected the gravity of amblyopia. The squint angle

was usually small among normal and retarded children with divergent squint and wider among mental defectives. The frequency of intermittent and alternating squint was also studied, as well as paralysis, convergence insufficiency, abduction deficiency, and combined vertical and horizontal squint. It seems that a distinction can be made between monosymptomatic, inheritable squint and a symptomatic squint with little or no hereditary predisposition. This monograph is based on statistical investigations and presented in 41 tables; it contains much more material than can conveniently be abstracted. (83 references)

John J. Stern.

Lijo Pavia, J. and Mogort, I. **Millimetric evaluation of surgery in concomitant horizontal strabismus.** Rev. oto-neuro-oftal. Sudam. **35**:43-48, June-Sept., 1960.

The authors review rather extensively the methods available to measure angles of deviation and discuss the different methods which have been described to evaluate the amount of correction obtained with horizontal muscle recessions and resections. They discuss the importance of the synoptophore to obtain a clear idea of the degree of fusion present but fail to give their millimetric evaluation of surgery, as one could expect from the title of their paper (3 figures, 29 references)

Walter Mayer.

Marin Amat, M. **The treatment of strabismus.** Arch. Soc. oftal. hispano-am. **20**:438-447, June, 1960.

The author describes his pattern of treatment of strabismus, developed out of clinical experience of almost half a century. He has seen amblyopic convergent eyes develop visual acuity following the loss of the fixing eye in people of advanced years. He believes therefore that retinal function can be re-educated at an advanced age. Sensory disturbances on the other hand must be corrected before the cerebral centers for fusion and binocular function have completed their development, which is in the early years of life. The more recent the onset of strabismus the better are conserved the central nervous centers and the memories of the motor movements necessary for normal convergence. The function of surgery is to break up the mechanism which holds the eyes in an abnormal position, and to place them in a new position, at which they have to coordinate their motor elements differently in order to awaken normal convergence. The same is accomplished by paralysis of accommodation with atropine, but the effect is less extensive and less permanent. The author has cured cases of congenital convergent strabismus of several days or weeks duration by using a one tenth percent solution of atropine instilled at gradually increasing intervals for a year or longer. In older children the author's pattern includes medical, optic, orthoptic and surgical phases. Accurate optical correction is essential in young children to prevent excessive accommodation and a disturbed relationship between accommodation and convergence. Surgery is not resorted to in children under three years of age, unless the deviation is very large. Treatment is begun by wearing the refractive correction, and the instillation of atropine, and orthopics. If this fails to correct the deviation surgery is done followed by the wearing of the refractive correction and orthoptic exercises. In adults treatment is begun by surgery followed by correction of the refractive error and orthoptic exercises. In alternating convergent strabismus surgery should be done early in order to avoid intractable diplopia. In amblyopic eyes the only therapy indicated is surgery for a cosmetic correction. The surgical procedures used by the author are recession of the contracted and resection of the weak muscle. Convergence

should be undercorrected and divergence overcorrected. The extent of surgery is not very significant in eyes with good vision, because the correction is physiologic rather than anatomical. In amblyopic eyes on the other hand the extent of surgery must be calculated with exactitude, because the result can not be improved by the subsequent correction of the refractive error or orthoptic exercises. Because strabismus appears in childhood which is a period of stress, it is important to include in the pattern of therapy general measures, pharmacological, dietetic and hygienic. Ray K. Daily.

Malbran, Enrique. **Surgery of vertical strabismus.** Arch. Soc. oftal. hispano-am. **20**:1014-1031, Sept., 1960.

It is essential to establish the etiopathogenesis of vertical and oblique strabismus. The cases may be divided into two large groups: 1. paralytic or paretic strabismus without sensory disturbance, and 2. innervational strabismus which constitutes the majority of cases and is always associated with sensory dysfunction. In paralytic strabismus surgery is the treatment of choice, and the type of operation is determined by the muscle involved, the duration of the paralysis, the appearance of the palpebral fissure, and other factors. Pure vertical strabismus is divided into two classes; concomitant hypertropias and hyperphorias, and pure alternating hyperphoria. Surgery is rarely indicated in these types of strabismus. The oblique innervational strabismus comprises the various types of the A and V syndrome and their treatment is surgical. The type of surgery suitable to the various cases is discussed and the technique for surgery on each muscle described in detail. (37 references) Ray K. Daily.

Rosa, D. **A case of chronic progressive extrinsic nuclear ophthalmoplegia.** Arch. di ottal. **64**:155-163, May-June, 1960.

This rare syndrome follows as acute episode resembling encephalitis. After the malaise, nystagmus, intention tremor, and other nervous symptoms disappear, the ptosis persists. The cause is unknown.

The case described was in an unmarried army pilot born in 1910. During the African campaign he contracted malaria. Later he had moderate pleuritis, blenorrhagia and epididymitis. At the onset of the present disease, he complained of ptosis and malaise, and he had to move his head to fix an object. The vision without glasses was 8/10 right and 1/10 left with normal visual fields. The pupils were equal, round, and reacted well to light and to accommodation. The consensual reaction was normal. The accommodation-convergence reflex was normal. Neurologic examination and X-ray studies of the skull were negative.

Later the Bietti operation for ptosis was done bilaterally with good results. (2 figures, 19 references) Paul W. Miles.

7

CONJUNCTIVA, CORNEA, SCLERA

Arai, T. **Serological studies of corneal heterografts.** Acta Soc. Ophth. Japan **63**:1582-1589, June, 1959.

In this experimental study on the antigenicity of heterogenous cornea, chicken cornea was dipped into rabbit serum for two to 15 days and then emulsified. The emulsion was tested for a precipitation reaction against antichicken rabbit serum. The antigenicity of the emulsion was considerably lower than that of an emulsion of chicken cornea which had been dipped into saline solution for the same period of time. In the second part of the experiment the serum treated chicken cornea was transplanted into the abdominal cavity of rabbits. The production of antibody was lower and of shorter duration than after transplanting saline treated chicken cornea. The author believes that the hetero-cornea may be used

after treatment with the serum of the receptor. (4 tables, 19 references)
Yukihiko Mitsui.

Borello, C. **A scleral cyst of traumatic origin.** Rassegna ital. d'ottal. **29**:89, March-April, 1960.

A ten-year-old girl was thrown from a motorcycle, had a head injury, and developed exophthalmos of the left eye. The bulbar conjunctiva was sutured and two weeks later there was complete loss of sight and persistent pain. The corneal tissue showed a band of scar tissue running from 7-o'clock to two, with bluish discoloration of the bulging iris. Five years after the injury the eye was removed and showed a scleral cyst, and calcification and ossification of the intraocular tissue. (3 figures) E. M. Blake.

Gormaz, A. **Double perforation of the cornea due to thermal burn.** Arch. chilenos oftal. **17**:44-46, Jan.-June, 1960,

The author presents the case of a patient with severe burns of the face which developed marked opacification of the cornea immediately after the accident. A perforation of both corneas occurred about nine days following the injury. The perforation of each eye was so extensive that a simple conjunctival flap was thought to be inadequate and a bilateral penetrating corneal graft was done with good results. The patient sees now 20/30 with his right eye and 20/100 with his left eye. It is planned to do further surgery on his left eye sometime in the future. (2 references) Walter Mayer.

Hirotsuji, I. **Experimental studies on the therapy of corneal serpiginous ulcer due to pyocyaneus.** Acta Soc. Ophth. Japan **63**:3117-3134, Aug., 1959.

In this study on rabbits, corneal infection by pseudomonas was induced experimentally. The animal was treated by means of antiserum, colistin, and by a combination of both. The antiserum by itself showed no effect. When it was used in combination with colistin, however, it accelerated the curative effect of colistin considerably. (8 figures, 10 tables, 40 references) Yukihiko Mitsui.

Klecker, W.: **"Keratitis bullosa" after cataract surgery.** Klin. Monatsbl. f. Augenh. **137**:444-449, 1960.

The literature on bullous keratopathy is reviewed. Case histories of two patients are reported. Bullous keratopathy occurred in both patients after surgery for cataract. Both corneas were involved in one of these patients who had a trephine operation prior to lens extraction. In cases of bullous keratopathy which are resistant to conservative therapy, and in those with considerable discomfort to the patient, resection of the greater superficial petrosal nerve can be attempted. Such treatment must be performed by a neurosurgeon and is reported to favorably influence the course of the condition in selected cases. The therapeutic effect lies in elimination of the tear secretion.
Gunter K. von Noorden.

Mitsui, Y. and Konishi, K. **Initial symptoms of trachoma.** Acta Soc. Ophth. Japan **64**:1388-1390, July, 1960.

The authors report their identification of trachoma virus cultivated in yolk sac. An American strain, Bour-strain, isolated by Hanna in California, was inoculated into a human volunteer. It resulted in an onset of typical acute trachoma. Numerous inclusion bodies appeared in the conjunctival scrapings after the onset of the disease. The authors emphasize the fact that the onset of trachoma is acute even if pure virus is used. (1 figure, 1 table, 4 references) Yukihiko Mitsui.

Morales, M. **Micotic keratitis treated with Griseofulvin.** Arch. chilenos oftal. **17**:47-50, Jan.-June, 1960.

The greater frequency of micotic corneal ulcers since the general use of antibiotics and steroids is mentioned. The case history of a patient with severe hypopion corneal ulcer is presented. The culture was positive for fungus and the ulcer only started clearing after the patient had been placed on Griseofulvin orally and by collyrium. (6 references)

Walter Mayer.

Ogata, S., Kurihara, H., Okamura, R., Tanaka, R. and Wakae, K. **Immunity to epidemic keratoconjunctivitis after vaccination and natural infection.** Acta Soc. Ophth. Japan **64**:1202-1205, July, 1960.

A definite immunity against re-infection develops after infection with epidemic keratoconjunctivitis. A vaccination with adenovirus type 8 is also effective in preventing the development of epidemic keratoconjunctivitis. The post-vaccination immunity is as strong as the immunity after natural infection. The immunity which results from either natural infection or vaccination lasts for at least several years. (3 references)

Yukihiko Mitsui.

Okada, H. **Studies on corneal rigidity.** Acta Soc. Ophth. Japan **64**:214-230, Jan., 1960.

This is an introduction to a ballistometric apparatus to measure the corneal extensibility and elasticity. In the first part the measurements in normal eyes are described. The corneal extensibility and elasticity decreases with age in persons over 20 years of age. In the last part the measurements in glaucomatous eyes are discussed. In most patients with primary glaucoma there is a decrease in corneal extensibility and elasticity but in secondary glaucoma they are increased. Thus Okada concludes that a decrease of corneal extensibility and elasticity (increase in rigidity) in eyes with primary glaucoma is not secondary to a high tension but is a primary change of glaucoma. (12 tables, 42 references)

Yukihiko Mitsui.

Okamura, R. **A study of pharyngoconjunctival fever.** Acta Soc. Ophth. Japan **64**:96-116, Jan., 1960.

This is a clinical, virological and serological study of pharyngoconjunctival fever (PCF); cases from several epidemics and some sporadic cases were studied. Most cases of PCF are the result of infection with adenovirus type 3. A comparison is made between PCF (mostly type 3) and EKC (epidemic keratoconjunctivitis) type 8. A mixed epidemic of PCF (type 3) and EKC (type 8) was also studied.

The PCF is usually transmitted through swimming pools. Sporadic cases of PCF are not common, while those of EKC are common. The PCF affects mainly children, while EKC frequently affects adults. A fever beyond 38.0°C is common in PCF, while it is exceptional in EKC except for the infantile form. A border-line keratitis may occur in PCF but typical subepithelial keratitis occurs only in EKC.

Cases of mixed infection of type 3 and type 8 show various clinical appearances. Some cases show symptoms of typical PCF (high fever) plus typical EKC (typical keratitis). Some others show merely either the symptoms of typical PCF or typical EKC.

Still there are some cases which only show conjunctivitis without accompanying fever and keratitis. The diagnosis can only be made by examination of paired sera. Virus isolation may miss one of the two types. (18 tables, 21 references)

Yukihiko Mitsui.

Ogata, S., Kurihara, H. and Okamura, R. **A study of pharyngoconjunctival fever.** Acta Soc. Ophth. Japan **63**:3212-3216, Aug., 1959.

An epidemic of pharyngoconjunctival fever (PCF) due to adenovirus type 3, sporadic cases of PCF due to type 3 and type 1, and a mixed epidemic of type 3 with type 8, are described. After a description of clinical, epidemiological, virological and serological results, the difference between PCF and EKC (type 8 infection) is discussed.

In PCF, regardless of the age of the patient, high fever is very frequently present. In EKC the systemic symptoms are exceptional in adults and children, and are only seen among infants. Typical subepithelial punctate keratitis occurs only by type 8 infection. In PCF borderline keratitis may occur in some exceptional cases but typical keratitis has not yet been observed. (4 figures, 6 tables, 5 references) Yukihiko Mitsui.

Ota, M. **Histological study of adenovirus infection.** Acta Soc. Ophth. Japan **63**:1395-1409, June, 1959.

This article records the results of human inoculation with adenovirus types 1, 3, 6, 7 and 11. Histologically the infection with type 3 showed a catarrhal character. The infection with types 1 and 6 showed a follicular-catarrhal character and infection with types 7 and 11 showed a typical follicular character just like the infection with type 8. (39 figures, 24 references) Yukihiko Mitsui.

Paton, R. T., Maumenee, A. E., Castroviejo, R. and Fine, M. **Symposium: corneal surgery:** Tr. Am. Acad. Ophth. Otol: **64**: Nov.-Dec., 1960.

I. Paton, R. T. **Introduction.** pp. 763-764.

The percentage of successful keratoplasties in 1959 is compared with that of 1947. Improvement has been remarkable. Currently one can expect favorable results in 85 to 90 percent of cases of conical cornea, 75 percent of hereditary dystrophy, 65 percent of Fuchs' dystrophy, and 75 percent of selected cases of luetic interstitial keratitis. The emergence of a new indication, therapeutic keratoplasty is noted. (2 tables)

II. Maumenee, A. E. **Biological responses to corneal homografts.** pp. 765-774.

Fresh corneas are still considered the most satisfactory material for penetrating keratoplasties. Corneas from children under five years of age are not acceptable. Enucleation should be performed within seven hours of death, and transplantation should be performed within 24 hours (though the limit is 48 hours) after enucleation. This avoids endothelial autolysis, thickening, and softening of the graft. Sterile technique is used, the globes are irrigated with a mild antiseptic, and the eyes are refrigerated in moist chambers at plus four degrees Centigrade. Corneas can be well preserved in mineral oil for five weeks, and for 19 weeks when dehydrated with 15 to 20 percent glycerol. For lamellar transplants one may use nonviable corneas dehydrated in 95 percent glycerin and stored in vacuum at room temperature; a claim has been made that such grafts never result in delayed opacification from the homograft reaction. Plastic material still is unacceptable for grafting.

Healing of the graft appears to depend on a symbiotic reaction between the stromal and epithelial cells. The epithelium and endothelium are soon replaced by the recipient, but the stromal cells appear to survive for at least three months. Immediate clouding of the graft is due to infection, traumatic displacement, poor apposition, foreign material in the wound (such as iris, lens or vitreous) and insufficiently fresh donor material.

Delayed opacification is usually due to the homograft allergic reaction, occurs from three weeks to two years after surgery and its severity is inversely proportional to the length of time the graft has

been clear. The allergic nature of this response is well documented. Blood groupings and tissue-specific antigens to corneal protein appear to be of little significance in this reaction. Delayed opacification also may be due to endothelial dystrophy in the recipient, keratinization, stromal herpes, and Moorens ulcer. Clarity of lamellar grafts is often reduced by crystalline deposits at the donor—recipient interface. (2 figures, 20 references)

III. Castroviejo, R. **Instrumentation and techniques of keratoplasty.** pp. 775-785.

Finer needles and suture material have made edge to edge suturing of the graft feasible now. Delicate needle holders and suturing forceps enhance their utilization, note being taken that magnification and intense illumination also are essential.

Indications for lamellar keratoplasty are listed: superficial opacities, herpes, pterygium, unruly and one-eyed patients, for example. Various knives and electrokeratomes are described for this technique.

Penetrating keratoplasty still remains the procedure of choice. Because of the improvement in technique, 8 mm. grafts can now be done without trepidation. Needless to say, the graft should always exceed the opacity in size, except in keratoconus where the graft should be larger than the coned area if possible. Grafts over 9 mm. in size should be accompanied by peripheral iridectomies. Synechiae, if they do occur, should be treated during the fourth postoperative week.

Total penetrating keratoplasty can now be performed although the percentage of visual improvement is small. Autokeratoplasty, when it is possible in such cases, carries a better prognosis. Usually the lens and all or most of the iris should be removed at the same time.

Mushroom-shaped grafts and keratoprosthesis implantation have been successful but have not yet been properly evaluated. Eyes with extensive scarring, such as those with chemical burns, should have preliminary conjunctivoplasties performed, and beta irradiation applied when indicated. (28 references)

IV. Fine, M. **Therapeutic keratoplasty.** pp. 786-808.

Although the mechanisms have never been satisfactorily elucidated, it certainly has been well documented that the application of a corneal graft will be of benefit in many eyes with inflammatory lesions. This salutory effect may be mediated through removal of the infective organisms, lessening of allergic response through interference with blood supply, removal of diseased or necrotic tissue, possible introduction of antibodies, and possibly a biological effect from the introduction of new tissue.

Therapeutic grafts have been used in eyes with herpes, rosacea, herpes zoster, trachoma keratitis, purulent lesions, abscess, or Mooren's ulcer. Good results were obtained in both types of herpes, and in trachoma. In herpes simplex good results were obtained even when the keratitis was deep. Syphilitic and tuberculous keratitis gave uncertain results.

In Fuchs' dystrophy penetrating keratoplasty gave good results, as it did in recurrent pterygium, descemetocele, and fistula; and lamellar grafts gave good results in late mustard gas keratopathy. Results were less rewarding in chemical burns, dystrophy after cataract surgery, and dystrophy secondary to uveitis.

In herpes recurrence usually takes place at a zone where diseased tissue was incompletely removed. In two cases dendritic ulcers formed in the clear transplant. Topical and parental steroids should be used non-the-less for two or three weeks preparatory to transplantation.

In lesions due to chemical burn, keratoplasty should be preceded by a careful

superficial keratectomy to remove the vascular membrane or pseudopterygium, peritomy and recession of the conjunctiva to a point 4 or 5 mm. from the limbus, and irradiation of the border of the recessed conjunctiva with a Strontium 90 applicator on the fourth or fifth postoperative day.

Certain notes of caution are made for lamellar work. When rupture of a descemetocele is feared, a trephine outline should be made. The recipient eye should be prepared before the graft. Efforts should be made to keep tiny foreign bodies from being deposited on the interface and paracentesis is often required to keep the recipient bed from bulging. (19 figures, 42 references)

Harry Horwich.

Pinero Carrion, Antonio. **Observations on keratitis profunda and therapeutic graft.** Arch. Soc. oftal. hispano-am. **20**: 1010-1013, Sept., 1960.

The author reports a case of deep, recurrent, chronic keratitis involving the iris. A therapeutic graft performed after all other therapy failed to arrest the attacks, resulted in recovery and a corrected visual acuity of 2/3. The author describes the salient points of his technique. (3 figures) Ray K. Daily.

Shordone, G. and Delogu, A. **Two cases of keratomalacia in adults.** Arch. di ottal. **64**:171-182, May-June, 1960.

Keratomalacia has been regarded as the end result of neglected vitamine A deficiency. However, it has also been attributed to atrophy of the glands of Harder with secondary infection, to trophic corneal changes from disease of the trigeminal or cervical sympathetic nerve, or to lack of lysozyme in the tears. Usually the xerosis bacillus, staphylococcus, diplococcus, or the Morax-Axenfeld bacillus can be cultured.

Two cases of adult blindness from keratomalacia are reported in which malnutrition was certainly involved. Perhaps there was defective intestinal absorption of vitamin A. (6 figures, 23 references)

Paul W. Miles.

Sugiura, S., Koike, K., Yokoyama, Y. and Kondo, Y. **The role of adenovirus type 3 and type 7 infection in epidemic keratoconjunctivitis (EKC).** Acta Soc. Ophth. Japan **63**:3452-3460, Sept., 1959.

This is a study of sporadic cases of EKC and similar conditions; 95 sporadic cases were studied. Serologically most of the infections were of adenovirus type 8. Only 3.1 percent were type 7 and 2.6 percent were type 11. The authors believe that some cases of type 7 infection may be included in "clinical EKC" but the infection of type 7 should not be included in "genuine EKC." (5 figures, 4 tables, 19 references) Yukihiko Mitsui.

Sugiura, S., Kondo, Y., Koike, K. and Koseki, S. **A study of adenovirus infection of the eye; results of virus isolation.** Acta Soc. Ophth. Japan **63**:947-952, April, 1959.

Twenty-two strains of adenovirus type 8 were isolated from patients in an epidemic of keratoconjunctivitis; 20 strains came from the conjunctiva and two strains from the cornea. Aside from type 8, four strains of type 7 and two strains of type 11 were isolated. Two of the four cases which gave type 7 virus showed a keratitis. In one of them the keratitis was epithelial and in another subepithelial. The patients positive for type 11 virus had epithelial keratitis only. From cases of clinical pharyngoconjunctival fever, some strains of adenovirus types 1, 3, 6 and 7 were isolated. Two of the four patients positive for type 3 virus showed a development of subepithelial keratitis. (1 figure, 1 table, 7 references)

Yukihiko Mitsui.

Tsutsui, J. **Clinical evaluation of the precipitin test as an indicator of the post-operative course in keratoplasty.** Acta Soc. Ophth. Japan **63**:1590-1594, June, 1959.

The clinical course after keratoplasty was comparatively studied in six cases. The precipitin reaction was tested using the donor cornea (the unused portion was used after lyophilization) as the antigen, and the receptor serum as the antibody. In two of the six recipients there was no formation of precipitin antibody against the donor cornea during the three-months-period after surgery. In the other four patients the antibody was formed during the period from five to ten days after surgery and it disappeared in 10 to 50 days. Corresponding to the formation of the antibody, there was a definite manifestation of iridocyclitis in all of the four cases. The inflammation was controlled, however, by administration of corticosteroids.

Tsutsui considers the precipitin test after keratoplasty useful, because the postoperative iridocyclitis due to antibody formation can be differentiated from that due to infection and malnutrition. The inflammation due to antibody formation can be controlled by corticosteroids but others can not be controlled. (2 figures, 16 references)

Yukihiko Mitsui.

Uchida, Y. **A strain of fibroblastic cells from rabbit cornea and its susceptibility to herpes simplex virus.** Acta Soc. Ophth. Japan **63**:3753-3763, Oct., 1959.

A strain of fibroblasts was obtained from rabbit cornea by a tissue culture technique; 22 passages were done during a five-months period and still the culture is stable. The strain is susceptible to the virus of herpes simplex. By inoculation of the virus the cells undergo a specific degeneration showing intranuclear inclusion bodies. (22 figures, 3 tables, 25 references) Yukihiko Mitsui.

Vigna, L. **A case of tuberculoma of the bulbar conjunctiva.** Rassegna ital. d'ottal. **29**, March-April, 1960.

The individual described was a man, 76 years of age, whose family and personal history were negative for tuberculosis. At the time of the first examination the right eye was injected and showed a swelling of the mucous membrane close to the limbus with an ulcerated apex. The latter may have been traumatic. The tuberculin test was positive (2 plus) and X-ray studies revealed nodules in the lungs. Medical treatment was intense and vigorous, yielding a good result. A biopsy showed much lymphogranular tissue. (3 photographs) E. M. Blake.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Vit, H. **Post-operative anterior chamber cysts and their operative treatment.** Klin. Monatsbl. f. Augenh. **137**:439-443, 1960.

Prophylaxis, symptomatology and complications as well as surgical treatment of anterior chamber cysts following intraocular surgery are discussed. Two cases are reported. These patients developed anterior chamber cysts after intraocular surgery and were operated on by the method of Safar, which consists in drainage of the cyst and its diathermization through a limbal incision. Care must be taken not to drain the aqueous humor during this procedure. (4 figures, 7 references) Gunter K. von Noorden.

Wakuzawa, A. **S study of experimental uveitis.** Acta Soc. Ophth. Japan **64**:78-88, Jan., 1960.

A uveal-adjuvant emulsion (the uvea of cattle was used) was injected into rab-

bits intradermally. Clinically hyphema was brought about in a few animals but clinical uveitis was absent in general. Histologic evidence was found for round-cell infiltration in the choroid of some animals. An elevation of complement fixation antigen was obvious in every animal. The antigen formation was definitely impeded by administration of a corticosteroid, but this effect of the corticosteroid was transitory. After cessation of the administration the antigen was normally produced. (14 figures, 4 tables, 18 references) Yukihiko Mitsui.

9

GLAUCOMA AND OCULAR TENSION

Barraquer y Cerero, Thomas, **The influence of a latent sinusitis on secondary glaucoma and on the tension of the fellow eye.** Arch. Soc. oftal. hispano-am. **20**: 1005-1006, Sept., 1960.

The author reports a very interesting case of right chronic iridocyclitis with hypertension and cataract, associated with constant pain in the normal left eye. An exhaustive general examination, including the sinuses and teeth was negative. All tests of the good left eye revealed no organic lesion. Failure of all therapy to relieve the patient of pain led to another rhinologic examination, which revealed bilateral maxillary sinusitis with involvement of the ethmoids on the left side. Drainage of the maxillary sinus was ineffective, and an operation was performed. Immediately after the operation the pain in the left eye improved and the tension in the right eye fell from 24 mm. Hg to 17. Ray K. Daily.

van Beuningen, E. G. A. **Practical advice regarding tonography.** Klin. Monatsbl. f. Augenh. **137**:613-620, 1961.

Practical advice regarding preparation of the patient, the electrotonometer, and the recording apparatus is given. Evaluation of the results according to Schiøtz scale units is preferred for clinical purposes. (1 figure, 2 tables, 4 references) Gunter K. von Noorden.

Diaz-Dominguez, Diego. **Ocular hypertension and high myopia.** Arch. Soc. oftal. hispano-am. **20**:1063-1068, Oct., 1960.

This investigation dealt with the relationship of glaucoma and high myopia. The authors performed tonometry on 100 patients with myopia of over ten diopters, and tonography on 25 patients with high myopia and ocular tension below 21 mm. Hg. The tabulated data of the tonometric examinations show that in high myopia the ocular tension is not lower than in hypermetropia or emmetropia and that ocular hypertension is more frequent than in other refractive states. Of the 25 patients investigated tonographically only 11 had a normal coefficient of filtration. The literature of this field is briefly reviewed and the etiologic relationship between glaucoma and high myopia discussed. (2 tables, 17 references) Ray K. Daily.

Draeger, J. **On the conditions of new and used Schiøtz tonometers.** Klin. Monatsbl. f. Augenh. **137**:483-494, 1960.

The author used 108 Schiøtz tonometers, 11 of which were new and 97 old, to determine whether they would meet Specification No. 4 of the American Committee for Standardization of Tonometers (March, 1952). The results were discouraging. Only two of the 11 new tonometers and none of the 97 used ones were correct. Considering the different testing criteria and comparing these with earlier measurements, it was found that the quality of tonometers has improved in general. The number of correct tonometers, however, is still extremely low. Testing laboratories can greatly aid in improving the quality of manufactured

tonometers. (5 figures, 3 tables, 19 references) Gunter K. von Noorden.

DuVall, C. **Cyclodiathermy with scleral flap.** Tr. Am. Acad. Ophth. **64**:809-815, Nov.-Dec., 1960.

The sclera is exposed by an incision through the conjunctiva and Tenon's capsule 6 mm. behind and parallel to the limbus. An incision is made in the sclera anterior to the insertion of the rectus muscles, parallel to the limbus, and for about one-third the circumference of the globe. A flap four-fifths the thickness of the sclera is dissected and reflected forward. A flat 1 mm.-surfaced electrode is used; it is set at the minimum current necessary to produce heat reaction. If the sclera shrinks and the pressure rises this reaction can be relieved by some penetrating applications. The flap is then closed. In seven out of ten aphakic eyes so treated the tension has been normalized, but the follow-up period has been very short. Some eyes were studied histologically by staining methods which demonstrate heat damage. The results on the ciliary body and choroid however were difficult to assess. It was noted though that heat alteration occurred far beyond the point of application. (4 figures, 1 color plate, 6 references) Harry Horwich.

Eggers, C., Kuester, C., Gonzalez, T. and Schaefer, L. **Aplanation tonometry.** Arch. chilenos oftal. **17**:27-34, Jan.-June, 1960.

The mechanics of regular tonometry are reviewed and the reasons why aplanation tonometry is more reliable are discussed. The aplanation tonometer and its uses are described and a comparison is made of its advantages and disadvantages over the classical Schiøtz tonometer. (1 table, 22 references) Walter Mayer.

Fernandez Gonzalez, Angel. **Late infection in fistulating operations.** Arch. Soc. oftal. hispano-am. **20**:976-993, Sept., 1960.

The literature on late infections after fistulating operations is reviewed, and the greater frequency of such infection after Elliott trepanations than after the La-Grange operation or iridencleisis is pointed out. Reference is made to the report of such infections in postoperative cases following gonioscopy and caution in this procedure is urged. Three microscopic sections at the level of the fistula from eyes enuleated with infection demonstrate how the infection begins in the fistula and from there spreads to the ciliary body, anterior chamber and vitreous. The importance of prophylaxis is emphasized; the author advocates the use of antiobiotics, care of the lacrimal passages, a thick conjunctival flap, and oblique position of the trephined area in the operation. Treatment of infection is discussed in detail, comprizing the use of antibiotics and chemotherapy as well as antiflogistic, desensitising, and antihypertensive agents. A case in which the patient recovered is reported. (5 figures, 19 references) Ray K. Daily.

Kishida, H. **The influence of low frequency waves on the eye.** Acta Soc. Ophth. Japan **64**:695-700, 1150-1156, April-June, 1960.

When a low frequency wave (less than 250 cycle/sec) is applied to the eye, it causes a lowering of ocular tension in glaucomatous eyes whereas it causes an elevation of ocular tension in normal controls. A low frequency current of 30 cycle/sec has the greatest effect.

When some agents such as epinephrine and pilocarpine are instilled into the eye prior to the low-frequency wave application, the wave causes a lowering of ocular tension both in glaucomatous and normal eyes. When benzyl-imidazoline is injected before the wave application, the wave causes an increase of ocular tension

in eyes with glaucoma and a fall in normal controls. Kishida believes that the effect of the low frequency wave on ocular tension is secondary to its effect on the autonomic nervous system. (10 figures, 13 tables, 16 references)

Yukihiko Mitsui.

Leydhecker, W. **Prognosis of glaucoma simplex in its early stage under treatment with miotics.** Klin. Monatsbl. f. Augenh. **137**:606-612, 1961.

During a large population study in 1956 a group of subjects were discovered who had glaucoma or were glaucoma suspects. Not all of these people followed the advice given by the examining group to see their ophthalmologist without delay. Most of these patients were re-examined after three years and the progression of the disease was recorded in those who were given miotic treatment shortly after discovery of glaucoma, and in those who refused any treatment. Visual acuity, Goldmann perimetry, ophthalmoscopy, applanation tonometry, and tonography were recorded. The author concludes on the basis of this study that sufficient therapy with miotics may prevent field loss. It is essential, however, to keep the pressure under 20 mm. Hg (4/55. gr. Schiøtz). If the pressure was elevated only slightly (22 to 26 mm. Hg) field loss occurred almost as frequently as when higher pressures were measured. The age of the patients did not exert significant influence on the deterioration of the visual fields. (2 tables, 6 references)

Gunter K. von Noorden.

Lorrente, J. **Anatomic-physiologic bases for the study of the central regulation of the ocular tension.** Arch. Soc. oftal. hispano-am. **20**:493-504, June, 1960.

The author reviews the literature but presents no new material. (37 references)

Ray K. Daily.

Moreu, Angel. **A subjective symptom of glaucoma.** Arch. Soc. oftal. hispano-am. **20**:1069-1071, Oct., 1960.

Moreu maintains that premature or excessive presbyopia inconsistent with the age of the patient is a sign of preglaucoma, and should alert the ophthalmologist. He believes that glaucoma begins with a circulatory disturbance in the anterior portion of the uvea, particularly in the ciliary body, and that anoxia in the ciliary muscle accounts for the pathologic presbyopia.

Ray K. Daily.

Oksala, A., Lehtinen, A. and Metsälä, P. **Experimental studies on the effect of high ocular tension on the ohmic resistance of corneal epithelium.** Acta ophth. **38**: 713-718, 1960.

No change of electrical resistance was noted in the corneal epithelium of enucleated eyes of cattle when the ocular tension was raised to 300 mg. Hg by injecting water into the anterior chamber. (2 figures, 15 references)

John J. Stern.

Perez-Bufil Pichot, Gabriel. **Surgery of primary glaucoma.** Arch. Soc. oftal. hispano-am. **20**:1112-1120, Oct., 1960.

The literature on the development of glaucoma surgery and the surgical indications are reviewed. The author's preference is for an iridectomy in acute glaucoma, and cyclodiathermy and cyclodialysis for the chronic glaucoma. The techniques of iridectomy and cyclodiathermy are described in detail. (7 references)

Ray K. Daily.

Ruiz Barranco, F. **Modification in the intraocular volume and tension by the arterial pressure.** Arch. Soc. oftal. hispano-am. **20**:484-492, June, 1960.

The objective of this study was to determine the effect of blood pressure on the rhythmic oscillations in tonography.

The invention of the electric tonometer made this investigation feasible. 150 eyes of 77 patients comprise the material for this study. The examination consisted of refraction by skiascopy, determination of astigmatism by the Javal ophthalmometer, tonometry by the Schiøtz and applanation tonometers, and determinination of the blood-pressure with the cuff above the elbow and the patient supine. The sources of error are discussed, and the data analyzed. The blood pressure variations and the scleral rigidity were found to have no effect on the amplitude of the tonometric oscillations. The chart of the effect of the ocular tension on the amplitude of the oscillations shows the maximum fluctuations between ocular tensions of 12 and 22 mm. of Hg, with the greatest fluctuation at 22 mm., diminishing to each side, and a more gradual fall on the side of increased pressure. The amplitude of the oscillations diminish with the increase in the intraocular volume. The average difference in the intraocular volume at the moment of systole and diastole is calculated to be 2.09 cc. (5 figures) Ray K. Daily.

Sakai, A. **The mode of action of adrenocortical hormone "Rindex" on the intraocular pressure.** Acta Soc. Ophth. Japan **64**:476-486, March, 1960.

Rindex, which contains a complex of adrenal-cortical hormone, causes a drop of intraocular pressure for eight hours when it is given to rabbits intravenously. The concentration of potassium ion is reduced in the aqueous. The bicarbonate ion is increased in the aqueous for the first two hours, then it begins to decrease. (6 figures, 5 tables, 45 references)

Yukihiko Mitsui.

Yonebayashi, M. **A study of intraocular pressure and blood-water content.** Acta Soc. Ophth. Japan **64**:855-868, May, 1960.

The diurnal variation of intraocular pressure and of the water content of the blood were measured in 10 glaucomatous eyes and in five normal controls. They showed no correlation. Then diamox was given to glaucomatous patients and the intraocular pressure was lowered. In most of the cases, however, the water content of the blood was not changed. Yonebayashi concludes that the effect of diamox on ocular tension is not secondary to a lowering of the water content of the blood due to diuresis. (5 figures, 5 tables, 47 references)

Yukihiko Mitsui.

Ytteborg, J. **Further investigations of factors influencing size of rigidity coefficient.** Acta ophth. **38**:643-657, 1960.

The rigidity coefficient (r.c.) was measured in 166 normal eyes with an applanation tonometer and a weight tonometer. The average r.c. shows a decrease with increasing age, and with increasing intraocular pressure. The variation with age is not significant; the variation with pressure, however, is significant. There is also a significant increase of the intraocular pressure with increasing age. The r.c. was determined manometrically in 50 enucleated human eyes of persons over 20 years old. The greater the volume of the eye, the lower the rigidity coefficient. Its increase with age is not significant, nor is the relation between it and the time between death and examination. (1 figure, 9 tables, 41 references) John J. Stern.

Ytteborg, J. **Investigations of the rigidity coefficient in children's eyes.** Acta ophth. **38**:658-674, 1960.

The differences in size, corneal curvature and wall structure of eyes of newborn children make the value of tonometer measurements questionable. Rigidity measurements with an electromanometer were therefore made on 50 enucleated

adult eyes and 16 eyes from children of various ages. The eyes of new-born infants have a much higher rigidity coefficient than the average for adults. Correspondingly, tonometer calibration on newborn eyes gives curves which lie far below the normal curves from the ordinary tonometer tables. Clinical rigidity measurements on 109 eyes of children under anesthesia aged five months to 10 years revealed an average rigidity coefficient of 0.0240, and an average scale reading of 4.4 with a 5.5g. weight. The danger of making a diagnosis of glaucoma on a normal infant eye on the basis of spuriously high tonometer readings is emphasized. (4 figures, 6 tables, 31 references) John J. Stern.

10

CRYSTALLINE LENS

Filbry, G. **Results of follow-up examinations after cataract surgery with enzymatic zonulolysis.** Klin. Monatsbl. f. Augenh. **137**:603-606, 1961.

The author examined 104 eyes more than 12 months after surgery. Vitreous hernias were present in 12 percent of the cases. No other complications, which could have been caused by the enzyme, were observed. (1 table, 4 references) Gunter K. von Noorden.

Kanzaki, N. **Studies of diabetic cataract due to alloxan.** Acta Soc. Ophth. Japan **63**:3712-3732, Oct., 1959.

This is a study of diabetes in rabbits due to alloxan. In the first part the clinical finding of developing cataract is described. Then the histology of the lens is discussed. The glycogen begins to appear in the lens slightly later than the appearance of cataract. The first sign of cataract is apparent as early as 13 hours after the administration of alloxan but the glycogen is demonstrated in the lens five days later and therefore the glycogen may not have a role in the development of diabetic cataract. In the second part of the report the systemic changes due to aloxan diabetes such as those in pancreas, pituitary gland, thyroid, testis, spleen and kidney are discussed. The most pronounced changes are degeneration of the B-cells of the islands of Langerhans. (34 figures, 5 tables, 93 references) Yukihiko Mitsui.

Küchle, H. J. and von Löwenstein, R. **Causes and sequences of vitreous loss in surgery of senile cataracts. Report on 1,325 cataract operations.** Klin. Monatsbl. f. Augenh. **137**:590-603, 1961.

Age of the patients, sex, blood pressure, and choice of surgical procedure were of no significant influence on the occurrence of vitreous loss during intraocular surgery. Myopia, however, appears to be a predisposing factor in this analysis. Iris prolapses and vitreous hemorrhages occur more frequently after vitreous loss. Other complications listed are: distortion of the pupil, vitreous opacities, retinal detachment, secondary glaucoma. The functional outcome of surgery was only slightly less favourable in the group with vitreous loss, when compared with the results in patients without this complication. (3 figures, 4 tables, 31 references) Gunter K. von Noorden.

Rhode, Jesus and Grom, Edward. **A case of mongolism with congenital cataracts.** Arch. Soc. oftal hispano-am. **20**: 505-511, June, 1960.

After a brief review of the characteristics of mongolism the author reports a case of a three-year-old boy with mongolism and congenital cataracts which were bilateral and diffuse, with dense subcapsular plaques. The mother of the patient, who was 36 years old at the time of conception, had an inferior coloboma of the iris in one eye, subtotal congenital cataract, anterior lenticonus, and em-

bryonal pigment remains on the anterior capsule. A review of the literature on the reported types of cataract in mongols indicates that there is no cataract typical of mongolism. Total cataract as in this case is very rare, but in view of the cataract in the mother a hereditary factor should be considered in this case. The pathogenesis of mongolism is discussed and advanced age of the mother is mentioned among etiologic factors. (3 figures, 14 references) Ray K. Daily.

Takagi, Y., Hoshina, M., Konishi, K. and Miki, T. **The influence of low atmospheric pressure on lens epithelium.** Acta Soc. Ophth. Japan **63**:2593-2601, July, 1959.

The authors first demonstrate that in rats anoxia is followed by a reduction in mitosis in the lens epithelium and that it is due to a reduction in the meta- and anaphase figures of mitosis. Then the authors demonstrate that the reduction of mitosis in the epithelium of the lens which is due to mono-iodo-acetic acid and dinitrophenol, is completely nullified by an administration of adenosine triphosphate (ATP). However, the reduction of mitosis which is due to anoxia is only slightly influenced by ATP, and the anoxic cataract is not influenced by this agent. On the other hand, 5-oxy-anthranilic acid completely depresses the development of anoxic cataract. Nevertheless, this substance shows only a slight influence on the mitosis reduction due to anoxia. From these facts, the authors conclude that the development of anoxic cataract and the reduction in mitosis count are two different things having no direct relation to each other. (2 figures, 18 tables, 12 references)

Yukihiko Mitsui.

Takagi, Y., Kiuchi, K. and Okamura, H. **Relation between sulfhydryl substance and cataract development.** Acta Soc. Ophth. Japan **64**:1381-1387, July, 1960.

It is well known that there is a definite decrease in SH-substance (sulfhydryl-substance) in the cataractous lens. This study is devoted to clarify whether the reduction in SH-substance by cataract is a local change or a systemic change. The sera from 38 cataractous patients and 16 normal controls were examined for SH-content employing an amperometric procedure. Care was taken to balance the age distribution of patients and controls. It was found that in cataractous patients there is a considerable decrease in SH-substance in the serum. The decrease is particularly apparent in incipient cataract and the rate of decrease averaged 10 percent.

To confirm this fact in experimental animals, the authors administered naphthalene to rabbits. A decrease in SH-substance in liver and serum resulted. When chlorobenzene was given, which has a similar effect as naphthalene except for the cataractogenic action, the SH-substance in the liver was reduced but that in the serum did not show any obvious change. These data suggest to the authors that a reduction in SH-substance in the serum may have a relation to the development of cataract. (10 figures, 4 tables, 15 references)

Yukihiko Mitsui.

NEWS ITEMS

EDITED BY DONALD J. LYLE, M.D.
411 Oak Street, *Cincinnati, Ohio*

News items should reach the editor by the 10th of the month. For adequate publicity, notice of postgraduate courses and meetings should be received three months in advance.

DEATHS

Dr. George Francis Joseph Kelly, Philadelphia, Pennsylvania, died October 6, 1960, aged 66 years.

Dr. Bernard John Larkin, Indianapolis, Indiana, died October 5, 1960, aged 73 years.

Dr. Merle Jasper Davis, Terre Haute, Indiana, died October 28, 1960, aged 42 years.

Dr. Roy Earl Mason, Saint Louis, Missouri, died November 20, 1960, aged 77 years.

ANNOUNCEMENTS

STRABISMUS COURSE

A course on strabismus will be given at the Presbyterian Medical Center of San Francisco on July 26th, 27th and 28th. Frank Costenbader, M.D., Washington D.C., will be guest lecturer. Arthur Jampolsky, M.D., and Edward Tamler, M.D., will be joint chairmen. The enrollment is limited. The registration fee is $100.00. For further information write the Secretary, Presbyterian Medical Center Eye-Bank, 2018 Webster Street, San Francisco 15, California.

HOME STUDY COURSES

The 1961-1962 Home Study Courses in the basic sciences related to ophthalmology and otolaryngology, which are offered as a part of the educational program of the American Academy of Ophthalmology and Otolaryngology, will begin on September 1st and continue for a period of 10 months. Detailed information and application forms can be obtained from Dr. William L. Benedict, the executive secretary-treasurer of the Academy, 15 Second Street S.W., Rochester, Minnesota. Registrations should be completed before August 15th.

BAYLOR COURSE

Baylor University College of Medicine, Texas Medical Center, Houston, Texas, in affiliation with Retina Foundation and Retina Service, Massachusetts Eye and Ear Infirmary, Boston, Massachusetts, announces a postgraduate course in ophthalmology, "Recent developments in ophthalmology." This meeting will be held June 5th, 6th and 7th, at Baylor University College of Medicine, Texas Medical Center, Houston 25, Texas. Lectures will correlate recent developments in research with clinical management or diseases of the cornea, vitreous and retina. The doctors attending this meeting are invited to bring patients who present diagnostic problems to be presented for the attending group's opinion. Guest speakers from the Retina Foundation will be Charles L. Schepens, M.D., Endre A. Balazs, M.D., Claes-Hendrik Dohlman, M.D., and Marie A. Jakus, M.D. Participating Baylor University College of Medicine Faculty will be Louis J. Girard, M.D., Louis Daily, M.D. and Alice R. McPherson, M.D. For application forms please write to: Department of Ophthalmology, Baylor University College of Medicine, Texas Medical Center, Houston 25, Texas.

MISCELLANEOUS

FIGHT FOR SIGHT AWARDS

The Fight for Sight awards of the National Council to Combat Blindness, Inc., New York, in the form of grants-in-aid, predoctoral and postdoctoral research fellowships, and student fellowships, made in June, 1960, are as follows:

Grants in aid

Edgar Auerbach, M.D., Hadassah University Hospital, Jerusalem, Israel, "Amblyopia and its central connection," $7,000.00; Gilbert Baum, M.D., Yeshiva University, New York, "A comparison of the acoustic properties of benign and malignant ocular tissues," $4,000.00; Nelly Blumenkrantz, Ph.D., Centro de Endocrinologia, National Health Department, Buenos Aires, Argentina, "Mucopolysaccharide content of aqueous humor and retrobulbar spaces in thyroid disease," $11,000.00; Robert Brunish, Ph.D., University of Virginia, School of Medicine, Charlottesville, Virginia, "Characterization of the ophthalmotrophic hormone," $6,095.00; Charles J. Campbell, M.D., Columbia University, College of Physicians and Surgeons, New York, "The determination of adaptometric thresholds of various regions of the retina in normal and pathologic subjects and the relation of the thresholds to the clinical appearance of the fundus," $5,072.00; Stephen Michael Drance, M.B., Ch.B., F.R.C.S. (Eng), University Hospital, Saskatoon, Canada, "Study of change of scleral rigidity and rise of intraocular pressure produced by water load in normal human eyes," $2,000.00; Olive Fedde Erickson, M.D., San Francisco Institute of Medical Sciences, California, "Lacrimal composition," $2,000.00; William C. Frayer, M.D., University of Pennsylvania, Philadelphia, "An experimental study on the proliferative properties of retinal pigment epithelium," $1,250.00; Frederick G. Germuth, Jr., M.D., and Laurence B. Senterfit, Sc.D., Charlotte Memorial Hospital, North Carolina, "Studies on antigen antibody reactions in the avascular cornea," $6,000.00.

Calvin Hanna, Ph.D., University of Vermont, College of Medicine, Burlington, "Studies on cata-

ract formation," $3,254.00; Mr. C. W. Hargens, The Franklin Institute of the State of Pennsylvania, Philadelphia, "Development, exploration and application of a glaucoma detector based on induced vibrations of the eyeball," $1,000.00; Kinnosuke Hirose, M.D., Nagasaki University Medical School, Nagasaki City, Japan, "Study of the Pulseless disease," $2,000.00; Michael J. Hogan, M.D., University of California, School of Medicine, San Francisco, "Special histopathologic study of endogenous uveitis," $5,000.00; Jerry Hart Jacobson, M.D., New York Eye and Ear Infirmary, New York, "Behavioral studies of higher level vision in monkeys," $6,000.00; Samuel J. Kimura, M.D., University of California, School of Medicine, San Francisco, "Effect of corticosteroid hormones on herpes simplex keratitis," $4,000.00; Roger Smith Kirkegaard, M.D., State University of Iowa, School of Medicine, Iowa City, "Evoked retinal and CNS responses in the cat during vitamin-A deficiency," $2,000.00; Walter Kornblueth, M.D., and Ernst Wertheimer, M.D., Hadassah Hebrew University, Medical School, Jerusalem, Israel, "Metabolism of orbital fat," $5,820.00; Narendra Krishna, M.D., Wills Eye Hospital, Philadelphia, "Electrophysiology of lacrimal gland," $5,000.00; Martin Lubow, M.D., University of Pennsylvania Graduate Hospital, Philadelphia, "Study of in vivo fibrinolytic activity of nicotinic acid in ocular tissues," $4,000.00.

Michel Mathieu, M.D., Maisonneuve Hospital, Montreal, Canada, "Studies on the retina of vertebrates," $6,000.00; I. C. Michaelson, M.D., Hebrew University Hospital, Jerusalem, Israel, "Evaluation of the clinical effects of cultured trachoma virus on human volunteers," $1,500.00; Yukihiko, Mitsui, M.D., Tokushima University, Tokushima, Japan, "Cultivation of trachoma virus in chick embryo," $2,000.00; Robert A. Moses, M.D., Washington University, School of Medicine, St. Louis, Missouri, "Investigation of zonulolysis with chymotrypsin," $5,000.00; Paul Muller, M.D., The Harlem Eye and Ear Hospital, New York, "Comparison in improvement in out-flow facility following various filtering procedures in colored glaucoma patients," $2,530.00; Antoinette Pirie, Ph.D., Nuffield Laboratory of Ophthalmology, University of Oxford, England, "Continuation of the study of changes in the constituents, metabolism and histology of the lens during development of cataract: Studies of proteins and peptides of the normal and pathologic lens: Expansion of study of chemistry and histology of the normal and pathologic vitreous body," $5,000.00; George K. Smelser, Ph.D., Columbia University, College of Physicians and Surgeons, New York, "Investigation on the pathogenesis of experimental exophthalmos," $2,760.00; Bradley R. Straatsma, M.D., and Raymond A. Allen, M.D., University of California Medical Center, Los Angeles, California, "A study of the human iris in normal and glaucomatous eyes employing light and electron microscopy," $5,000.00.

Jun Tsutsui, M.D., Okayama Rosai Hospital, Okayama-shi, Japan, "Immunochemical studies of corneal protein in homo- and hetero-corneal graft," $1,400.00; Paul Weinstein, M.D., Szabolcs Street's Medical Postgraduate Institute, Budapest, Hungary, "Early diagnosis of glaucoma," $1,070.00; Jerome J. Wolken, Ph.D., University of Pittsburgh Medical Center, Pittsburgh, "Photoreceptor structures: A phylogenetic study of the development of retinal structures," $3,132.00; Moshe Wolman, M.D., Government Hospital, Tel-Hashomer, Israel, "Changes in retinal and renal capillaries as induced in the Schwartzman phenomenon," $1,000.00.

Special awards

Children's Eye Clinic. Columbia Presbyterian Medical Center, New York. $39,000.00 to aid in the establishment and first year of maintenance of a special service to diagnose, administer treatment and care to infants and children requiring such attention. The Fight for Sight has assured continuing support for its annual maintenance for a minimum period of five years. This is believed to be the first eye clinic exclusively designed for children in a general hospital in the Eastern United States and the second in the nation. In addition to rendering patient care, this service will collect data which it is felt may contribute significantly to opening new avenues of research investigation in pediatric ophthalmology and ophthalmology generally.

Trachoma mobile unit. Department of Ophthalmology, Hadassah University Medical School, Jerusalem, Israel, $1,500.00 for continued aid in extending its trachoma control program through examination and treatment to the populations in outlying sections where such eye care has been inaccessible. This unit, under the direction of I. C. Michaelson, M.D., was initially established with the support of the National Council to Combat Blindness with the view that it would serve as a model for the establishment of other such units in that area of the world.

International Society for Clinical Electroretinography. $1,000.00, for the quarterly publication of a *Newsletter* the function of which is to increase the speed of dissemination of information concerning new developments in this field.

Columbia University College of Physicians and Surgeons, New York, $250.00 to assist in defraying cost of symposium on "Structure of the eye," International Congress of Anatomists, under chairmanship of George K. Smelser, Ph.D., Department of Anatomy.

Predoctoral and postdoctoral research fellowships

Arthur Berken, M.D., Government Hospital, Tel Hashomer, Israel, "The production of lesions resembling those of diabetic retinopathy and Kimmelstiel-Wilson's disease," $4,500.00; Edward Cotlier, M.D., Washington University, School of Medicine, St. Louis, "Hormone effect on lens epithelium," $3,600.00; Franz Fankhauser, M.D., Washington University, School of Medicine, St. Louis, "The

relative density of scotomas in strabismus and factors influencing the relative density," $7,500.00; Bengt Olof Hedbys, M.D., Retina Foundation, Boston, "Continued studies on the water uptake by corneal stroma, $6,500.00; Warren L. Kleinsasser, University of Minnesota, Medical School, Minneapolis, "In vitro metabolism of the lens in various glucose concentrations," $1,800.00; Ulla B. G. Laurent, M.D., Retina Foundation, Boston, "Studies on the proteins of the vitreous body," $5,000.00; Arthur Bruce Leith, M.D., University of London, England, "Measurement of episcleral and aqueous vein pressures in open-angle glaucoma," $3,000.00; H. Maisel, M.B., Ch.B., McGill University, Montreal, "Isolation of the lens proteins and lens antibodies and their influence on the growth and development of the lens and eye," $5,000.00; Maria Th. Mattonvan Leuven, M.D., Duke University Hospital, Durham, North Carolina, "Long-term preservation of animal and human corneas for perforating corneal grafts," $3,975.00; Carl Heinrich Mordhorst, M.D., University of California Medical Center, San Francisco, "Ocular virology in California and Denmark," $5,000.00; Arthur M. Silverstein, Ph.D., travelling fellowship, "Advanced training and research in the immunochemistry and immunopathology of ocular hypersensitivity," $5,000.00.

Student fellowships

Thomas A. Aaberg, Massachusetts Eye and Ear Infirmary, Boston, "Investigation and determination of the rate of aqueous humor production by the installation (chronic) of a catheter into the anterior chamber of the eye: And the response of this determined rate to various pharmacological agents, $600.00; Richard W. Beighle, University of Oregon, Medical School, Portland, "Experimental carrageenan granuloma of the guinea pig cornea," $750.00; Charles J. Berwald, University of Michigan, Medical School, Ann Arbor, "Optical activity of lactic acid produced by bovine lens in vitro," $705.00; Laszlo Bito, Columbia University, College of Physicians and Surgeons, New York, "Thymidine incorporation in ocular tissues following injury," $750.00; Charles E. Blair, University of California Medical Center, San Francisco, "Tissue culture studies of ocular tissues; the in vitro effect of Diamox on the secretory epithelium of the ciliary body," $600.00; William J. Casey, II, Johns Hopkins University, School of Medicine, Baltimore, "Fluorometric studies on aqueous humor flow in rabbits," $500.00; Gordon S. Cohen, Yale University, School of Medicine, New Haven, "Experimental studies of specific and nonspecific cholinesterase by localizing and comparing the sites of activity of both enzymes with light, and electron microscopes, using extrinsic eye muscles and retinas of rodents," $675.00; Richard A. Davidson, New York Hospital-Cornell Medical Center, New York, "A continuation of the investigation relating blood osmolality to intraocular pressure," $600.00; John Gunnar Elmquist, Northwestern University, Medical School, Chicago, "Enzymology of the refractory media: Investigation of peptidases in the rabbit lens," $600.00.

Robert N. Frank, University of Pittsburgh, School of Medicine, Pittsburgh, "Studies on the chemistry of photoexcitation," $500.00; Richard M. Hill, University of California, Berkeley, "The electrophysiologic aspects of color vision," $600.00; Howard M. I. Leibowitz, Johns Hopkins University, School of Medicine, Baltimore, "Studies on ocular hypersensitivity," $900.00; Munro J. Levitzky, Columbia University-Presbyterian Hospital, New York, "Determination of the fate of the endothelium in corneal grafts by sex chromosomal studies," $900.00; Gerald L. Mandell, New York Hospital-Cornell Medical Center, New York, "Studies to calculate aqueous flow in pathologic conditions using methods not previously studied in detail," $600.00; Henry S. Metz, State University of New York, Downstate Medical Center, Brooklyn, "Studies on the proteolytic enzyme of steer lens fibers and capsule," $600.00; Leonard Naiman, Northwestern University, Medical School, Chicago, "In vivo inhibition of lens enzyme: Effect of micro-injection of various enzyme inhibitors into lens," $600.00; James E. O'Brien, Ph.D., University of Vermont, College of Medicine, Burlington, "Intracellular biochemical changes in the eye during gallactose cataract formation," $420.00; John L. Overby, Tulane University, School of Medicine, New Orleans, "Immunochemical analysis of corneal proteins: I. Comparison of various animal species," $600.00; Bruce W. Parker, Northwestern University, Medical School, Chicago, "In vivo inhibitions of lens enzymes," $600.00.

James A. Rawls, Jr., University of Florida, College of Medicine, Gainesville, "Study of the carbonic anhydrase system as it relates to the eye and other organs in various states of electrolyte unbalance," $900.00; Robert D. Reinecke, M.D., Massachusetts Eye and Ear Infirmary, Boston, "Refinement of a technique for objective measurement of visual acuity by the use of the optokinetic nystagmus," $900.00; James F. Stiles, State University of Iowa, College of Medicine, Iowa City, "Penetration of adrenal corticoids in the normal and pathologic eye," $600.00; "The penetration of C^{14}-labelled hydrocortisone into normal and pathologic rabbit eyes," $700.00; Shigemi Sugiki, Washington University, School of Medicine, New Orleans, "Tissue culture of the ciliary body epithelium: Effects of benemid, diodrast, and penicillin," $900.00; Cynthia Thomas, Massachusetts Eye and Ear Infirmary, Boston, "The formation of aqueous humor and the maintenance of intraocular pressure in squalus acanthias," $750.00; Saeko Watanabe, Okayama Rosai Hospital, Okayama-shi, Japan, "Immunochemical alteration of proteins in lyophilized corneal heterograft," $250.00; David A. Weeks, University of Oregon, Medical School, Portland, "Cinematography of the fundus," $600.00; James D. Weinstein, University of Pennsylvania, School of Medicine, Philadelphia, "Investigations of the vascular architecture of the head of the monkey

with particular emphasis on the orbit and optic nerve," $900.00; "The pathogenesis of papilledema," $200.00; Anna Marie Wieland, University of Illinois, College of Medicine, Chicago, "Evaluation of a wave in clinical electroretinography," $600.00; Aaron Wigdor, New York University, Post-Graduate Medical School, New York, "Experimental production of glaucoma in rabbits," $600.00.

Louisville course

Dr. F. Bruce Fralick, professor and chairman of the Department of Ophthalmology at the University of Michigan, Ann Arbor, was the visiting professor in the Department of Ophthalmology of the University of Louisville during February. Dr. Fralick gave a series of lectures on "Minor surgery of the eye," "Emergency management of eye injuries," and "Para-orbital lesions." At the faculty seminar he discussed the "Epidemiology of the suspected causes of uveitis." In addition to his formal lectures, Dr. Fralick also conducted teaching rounds with the residents and held clinics on interesting problem cases.

Far East course

The first Far East graduate course in ophthalmology, sponsored by the Secretary of Health of the Philippines Republic, the United States Air Force, the Ophthalmological Society of the Philippines, and the Philippine Ophthalmological and Otolaryngological Society, was given in Manila during January at the new auditorium of St. Luke's Hospital.

Dr. Brittain F. Payne, chairman of the course, and Dr. Gerald B. Kara of the New York Eye and Ear Infirmary, assisted the local Manila executive committee in presenting the first course. The chairman for the entire event was Dr. Herminio Velarde, Jr., a former resident and distinguished alumnus of the New York Eye and Ear Infirmary. He was assisted by a committee composed of Drs. Jesus Eusebio, co-chairman; Ramon Batung-bacal, Jose O. Chan, Jose N. Cruz, Felisa N. Fernando, Ramon Ongsiako, Jr., Severino Lopez, Edmundo Reyes, Sabino Santos and Carlos Sevilla. Other former residents of New York Eye and Ear Infirmary who participated in the program were Drs. Ramon Ongsiako, Jr., Augusto Kohtiao, and Cesar Villafuerte.

The course was attended by 80 graduate students representing the larger Philippine islands, Bangkok, Thailand, Hong Kong, Taiwan, Indonesia and South Vietnam. The course was so enthusiastically received by the Far Eastern students that a request was made to have the entire program repeated again next year. Dr. Kara demonstrated ophthalmic surgical procedures on closed circuit television.

An award of appreciation in the form of a bronze plaque was presented to the professorial lecturers, including Drs. Payne and Kara of the New York Eye and Ear Infirmary.

Societies

Pennsylvania meeting

The 18th annual meeting of the Pennsylvania Academy of Ophthalmology and Otolaryngology will be held at the Bedford Springs Hotel, Bedford, Pennsylvania, on May 18th, 19th and 20th. At the combined meeting the program will be:

"Symposium on good office management," Norbert Alberstadt, Erie, moderator; "Practical considerations," Jay G. Linn, Jr., Pittsburgh; "Management of good public relations," Edward Raffensberger, Harrisburg; "Role of professional management consultant," William G. Harry, Philadelphia.

The ophthalmology program includes:

"Ptosis," Raynold Berke, Hackensack, New Jersey: "Diagnosis and treatment of tumors of the eye in infancy and childhood," Charles E. Iliff, Baltimore; "Developmental cataracts," Harold F. Falls, Ann Arbor, Michigan; "Panel on problem surgery," Glen Gibson, Philadelphia, moderator, and Drs. Berke, Iliff and Alston Callahan, Birmingham, Alabama, panelists.

Instruction sessions in ophthalmology include:

"Surgical techniques," Dr. Iliff; "Ophthalmology in India," Octavius Capriotte, Souderton; "Lacrimal sac problems," J. V. Cassidy, South Bend, Indiana; "Ophthalmic anesthesia," Kenneth Vey, Pittsburgh; "Study club on contact lens problems," Edward C. Tait, Norristown, moderator, George Martz, Harrisburg, and Edward Kulczycki, Sayre, panelists; "Surgical management of small angle squint," E. Howard Bedrossian, Drexel Hill; "Ocular geriatrics," Dr. Falls; "Management of ocular tumors," Philip Spaeth, Philadelphia.

Oregon Academy

Dr. Arthur G. DeVoe, New York, and Dr. Bradley R. Straatsma, Los Angeles, were guest speakers at the 20th annual Ophthalmology and Otolaryngology Postgraduate Convention of the Oregon Academy of Ophthalmology and Otolaryngology and The University of Oregon Medical School.

Fort Worth meeting

On the program of the one-day eye meeting at the Fort Worth Academy of Medicine Building, Fort Worth, Texas, sponsored by Alcon Laboratories, were: "Recent developments in the treatment of infectious diseases of the eye," James H. Allen, New Orleans; "Allergies of the conjunctiva," Alson E. Braley, Iowa City; "The choice of surgical procedures in congenital cataract surgery," Frederick C. Cordes, San Francisco; "The use of thin conjunctival flaps in the treatment of corneal pathology," A. Edward Maumenee, Baltimore; "Surgical approach to the A-V syndromes," John M. McLean, New York; "The use of homologous dura mater in ophthalmic plastic surgery," Merrill J. Reeh, Portland, Oregon; "Present status of iridectomy with scleral cautery," Harold G. Scheie, Philadelphia.

New York-Cornell meeting

The second annual meeting of the New York Hospital-Cornell Medical Center Eye Residents Alumni Association was held at the New York Hospital on March 27th and 28th.

Kansas meeting

Speakers at the Postgraduate Course in Ophthalmology at the University of Kansas School of Medicine, Kansas City, Kansas, were: Louis J. Girard, Houston; Edward W. D. Norton, Miami; Marshall M. Parks, Washington, D.C., and Larry L. Calkins, Albert N. Lemoine, Jr., Earl G. Padfield, Bradford Prokop, James T. Robison, Jr., Truman B. Schertz, and Dick H. Underwood of the University of Kansas Medical School faculty.

Irish Ophthalmological Society

The Irish Ophthalmological Society will hold its annual meeting in Dublin on April 27th, 28th and 29th. The Montgomery Lecture will be given by Prof. François of Ghent in the Royal College of Surgeons, Dublin, on Thursday, April 27th.

Brooklyn speakers

Speaking before the Brooklyn Ophthalmological Society at its meeting on March 27th were: Dr. E. A. Balazs, Retina Foundation, Boston, Massachusetts, "The molecular biology vitreous body," and Dr. C. D. Binkhorst, Perneuzen, Holland, "The pupillary lens in aphakia."

Postgraduate courses for specialists

The fourth series of postgraduate courses for specialists in ophthalmology will be given from September 14th to November 15th. The courses will include the following: Advances in ocular prostheses, anomalies of extraocular muscles (including ptosis), biomicroscopy, biomicroscopy: using near ultraviolet, cobalt blue, polarized light and infrared lights, clinical bacteriology, clinical problems of tear formation, complications of ophthalmologic surgery, contact lenses, electrophysiology and applied physiology of the eye, enucleation and evisceration, glaucoma, gonioscopy, keratectomies and keratoplasties, lacrimal sac surgery, light coagulation (Meyer-Schwickerath apparatus), low vision aids, ocular biochemistry, ocular geriatrics, ocular neuro-ophthalmology, ocular photography, ocular radiology, ocular therapeutics, ophthalmoscopy, orthoptics, pathology, pediatric ophthalmology, perimetry, physiological optics, plastic eye surgery, pleoptics and macular function testing, psychosomatic factors in ophthalmology, radio-isotopes in ophthalmology, recent advances in cataract surgery, refraction, retinal detachment, surgery of the orbit, tonography, and uveitis.

For catalogue and additional information, please write to: Mrs. Tamar Weber, Registrar, Institute of Ophthalmology of the Americas, New York Eye and Ear Infirmary, 218 Second Avenue, New York 3, New York.

Personals

At the dedication ceremonies of the new Ophthalmic Hospital of the Order of St. John in Jerusalem (see THE JOURNAL, 51:540, 1961), Brig. Sir Stewart Duke-Elder, G.C.V.O., F.R.C.S., etc., Hospitaller of the Most Venerable Order of the Hospital of St. John of Jerusalem, was invested with the Bailiff's Grand Cross by the Lord Prior, Lord Wakehurst, representing H.R.H. the Duke of Gloucester, the Grand Prior.

The statutes of the Grand Priory include this statement: "Bailiff's Grand Cross promoted by the Grace of the Sovereign Head, shall be selected from those Knights of the Order who are of eminence in the State and/or have rendered conspicuously valuable and long-continued service to the Order; they shall not exceed ten in number."

The Bailiff's Grand Cross insignia is three and one-fourth inches in size, of enamel and gold suspended on a riband four inches in breadth (this is two inches wider than that of the Ordinary Knight of the Order). The riband is worn over the right shoulder of the Baliff's Grand Cross.

At the same investure, Air Commodore—Thomas Keith Lyle, C.B., M.A., M.D., M.R.C.P., F.R.C.S., Deputy Hospitaller of the Order of St. John, was promoted to Knight.

At the 73rd annual meeting of the Société Française d'Ophthalmologie, Paris, 1960, Conrad Berens of New York was elected a member of the council, replacing Arruga of Barcelona.

Roland I. Pritikin, M.D., Rockford, Illinois, president of the Henry Holland Hospitals Alumni Association and Fund, addressed the Kobe (Japan) Society of Ophthalmology, the Hong Kong Ophthalmological Society, the Philippine Ophthalmological Society, the Department of Ophthalmology, University of the Philippines, and other ophthalmological groups in the Far East during January, 1961.

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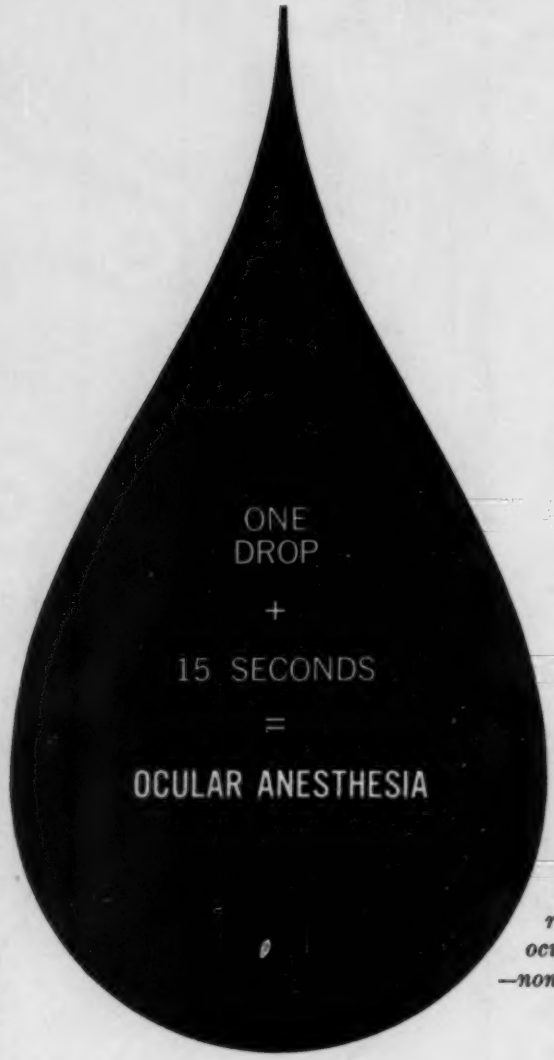

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